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ABSTRACT

This packet contains the instructional materials necessary for presentation of the sixth of ten modules which comprise a portion of the National Training and Development Service Urban Management Curriculum Development Project. This module focuses on performance/program budgeting which combines and extends fiscal planning and control elements from the management orientation of performance and the planning orientation of program budgeting. The module materials address the evolution of public budgeting; uncertainty, risk, and innovation; effective budget preparation; major components of a performance/program budget; and analytical approaches in public budgeting. (Author/MK)

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PERFORMANCE/PROGRAM BUDGETING

Prepared by Dr. Alan Walter Steiss

Module Number Six
of
POLICY/PROGRAM ANALYSIS AND
EVALUATION TECHNIQUES   Package VI

Developed by

CENTER FOR URBAN AND REGIONAL STUDIES
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CHAPTER 1

CURRICULUM MODULE SCOPE AND PURPOSE

Successful implementation of public policy is dependent upon a comprehensive system for the effective allocation of available resources to carry out public programs. Choices must be made among various courses of action with the fullest knowledge possible as to the implications of each alternative. To achieve such knowledge, quantitative and qualitative management information must be collected, analyzed, and communicated in a systematic fashion. The budget provides a principal mechanism for accomplishing these public policy and management objectives.

The formulation of a public budget is a complex process. Decisions that have major implications for the future of the community often must be made under conditions of uncertainty and risk. Systematic budgeting procedures can help to reduce uncertainty and bring risk within a more tolerable range. Before a budget can be formulated, however, goals and objectives must be identified, policies must be analyzed, and comprehensive plans and programs must be delineated. Making choices about ends and means specifically involves political decisions regarding the allocation of scarce public resources. Thus, budgeting is the public substitute for the economic mechanisms of the private market system.

The budget serves as a principal means by which government may be held accountable for its actions. Budgeting is also a control process whereby revenue and expenditure information is collected and organized to facilitate program planning and management and performance evaluation.

Budgeting--through the interaction of these aspects of planning, politics, economics, accounting, and control--takes its place among the principal vehicles for the formulation of public policy. When seen in this light, budgeting becomes a continuous, dynamic, and extremely influential management process.

The traditional purposes of public budgeting have been to ensure legality, accuracy, and conformity to the legislative and administrative mandates set forth in laws, ordinances, and regulations. From its inception, the budget in local government has been viewed as a mechanism for fiscal control. Beginning in the thirties, the budget began to take on new management dimensions as data on work units, manpower allocations, unit costs for equipment and supplies, and other indicators of service, activities, and work tasks began to emerge from a performance orientation to budgeting. In addition to reflecting the legal authorization for the expenditure of funds, such budgetary information provides management with important indices as to the efficient and economical accomplishment of work.

More recently, the budget has come to be recognized as an important tool for planning and policy implementation. By developing more definitive goals, objectives, targets, and activities in the formulation of budget requests, public agencies are better able to critically analyze their operations in terms of effectiveness as well as efficiency and economy. Working from manhours, work units, and other measures, but organizing these data through a programmatic framework, public agencies can gain a fuller understanding of the interrelatedness of public programs and projects and thereby, establish a sounder basis for the delivery of public services.

The processes and procedures of performance/program budgeting discussed in this curriculum module are not a panacea to the current fiscal crisis confronting many local governments. This approach, however, does provide a method of organizing financial and management information in a more functional and useful form. While easy answers to the financial responsibilities of local government have yet to be found (and are not likely soon to be discovered), many jurisdictions are building on the experiences of over a half century of budgeting to provide a more comprehensive and responsive financial management system that the turbulence of our urban society demands.

MODULE FORMAT AND OBJECTIVES

It has been said that "a picture is worth a thousand words." In the field of public service education, first-hand experiential applications of new concepts and techniques often are worth a thousand pages of theoretical textbook presentations of these same concepts and techniques. This is not to suggest that cookbook, "how-to-do-it" materials can or should replace a good theoretical grounding in urban management concepts and techniques, but rather that many contemporary tools of management can only be fully appreciated through real-world (or near real-world) applications.

One of the central problems, however, in the development of effective educational programs for urban management personnel is the almost total lack of good instructional materials to provide student participants with a "hands-on" experience in dealing with new concepts and techniques. While textbook case studies report on the experiences of particular localities in the application of various new management techniques, these presentations provide only limited opportunity for the student to work through problem situations and to experience firsthand the "discovery of application." Numerous "war stories" also can be drawn from the firing-line experiences of urban management practitioners. These anecdotal materials, however, seldom provide the necessary content to be used for instructional purposes.

As a consequence, new concepts and techniques in the field of urban management are either presented in the abstract, leaving students and practitioners to their own devices to discover potential applications to more specific problem situations, or are discussed as fait accomplis, providing little opportunity to discern the internal problem-solving mechanisms employed in the application of these techniques. Thus, the recalcitrance among public service personnel regarding the use of new methods often stems from the lack of tangible examples of application. A fundamental objective of this curriculum development project, therefore, is to provide a vehicle to assist in circumventing these impediments to fuller application of public management concepts and techniques.

Module Focus and Approach

This curriculum module, the sixth in a series prepared by the staff of the Center for Urban and Regional Studies at Virginia Tech, focuses on the concepts and techniques of performance/program budgeting as they serve the process of Policy Analysis and Evaluation. The module consists of instructional materials and a series of six case studies and related scenario problems that examine the application of important tools of modern public budgeting.

The instructional materials in this module are based on a major textbook by Dr. Alan Walter Steiss, entitled Public Budgeting and Management, published by Lexington Books-D.C. Heath and Company (1972) of Lexington, Massachusetts. This text, along with several other books cited in the accompanying bibliography, serve to further elaborate the points discussed in these curriculum materials.

The case study/scenarios illustrate critical procedures and techniques of performance/program budgeting and cover the following topics:

(1) Decision-Making Under Risk (chapter 3)

(2) Sensitivity and Contingency Analysis (chapter 3)

(3) Unit Cost Analysis (chapter 4)

(4) Performance/Program Budget Crosswalk Techniques (chapter 5)

(5) Critical Path Method (chapter 6)

(6) Cost-Benefit/Effectiveness Analysis (chapter 6)

The case studies are drawn from real-world situations suggested by the experiences of urban management practitioners. Each case study provides closure on a problem situation, illustrating a given set of concepts, methods, and/or techniques that participants will require to solve the associated scenario problems. Basic concepts also are discussed in the instructional materials to clarify the application of particular techniques. Of necessity, certain abstractions have been made in the case studies so that they will be manageable within a workshop/seminar format.

The scenarios build upon the case studies (utilizing data, assumptions, situational and contextual factors, etc.). These scenarios require additional participant inputs beyond the case study, however; i.e. they involve more than the mere mechanical application of techniques outlined in the case studies. One obvious component of the scenario problems would involve an analysis and critique of the assumptions and methodologies applied in the case studies.

Each case study/scenario includes an "instructional guide" that outlines the basic objectives covered, identifies relevant supporting information with which the participants should be familiar, and as appropriate, provides a solution or range of possible solutions to the scenario problem. These instructional guides may be distributed separately after the conclusion of the discussion on the scenario problem or may be used as part of that discussion. Data provided in the instructional guide also may be used to "short-cut" or simplify some of the calculation requirements of the scenario problems.

Instructional Assumptions

The case study/scenarios are designed to be used primarily as part of a short course/workshop in conjunction with in-service training programs for public managers and local government officials. The module represents 16 to 24 didactic hours, the time duration depending on the pre-workshop reading of instructional materials that may be done by the participants. The modules may be used in concert with an intensive lecture/seminar format that combines a high level of participant input within a fairly structured learning environment. These instructional materials would also have application in public administration and urban affairs curricula at the upper division undergraduate and at graduate levels.

The case study/scenarios can be combined in various ways in accordance with participant needs. They are also adaptable to a variety of presentation formats (e.g., a series of relatively short in-service workshops spread over several months, more intensive training institutes, perhaps used in combination with materials from other modules in this series, quarter or semester long credit courses, etc.). The case studies and scenarios can also be used in conjunction with the instructional materials as a "self-study" package by individuals. Practitioners might find application of the case study/scenarios, independent of any formal instruction, to demonstrate the utilization of particular management techniques, as for example, to provide a "walk through" experience for members of city council.

In short, while the materials are designed primarily for use in conjunction with an instructor/facilitator, they are sufficiently self-contained to be applied in several other contexts, including use as "self-study" materials. Instructors using these materials in more formal workshop or classroom settings should have some knowledge of public budgeting procedures and the techniques of cost-benefit and cost-effectiveness analysis (the subject of curriculum module 5 in this series). Expertise in these areas is not assumed, however, and an instructor should be able to gain sufficient familiarity with these basic concepts by consulting the various textbooks listed in the accompanying bibliography.

No special equipment or reference materials are required beyond that which is provided in the curriculum package, aside from the desirability to have small electronic calculators available for participants to work out portions of the scenario problems (such calculators that have a memory and reciprocal function are advised). If used in conjunction with an academic course, many of the computational routines are adaptable to computer operations. Repetitive computations can be derived from the instructional guides, however, to facilitate the use of these materials in more intensive workshop sessions (i.e., participants may be required to set up the problem for solution without having to work through all of the calculations).

Module Audience

The primary audience for these case study/scenarios and supporting instructional materials will be urban managers--city managers, urban county administrators, department heads, planning staff members, and other similar public service personnel with responsibilities for public budgeting and financial management (and degree candidates preparing for such public service careers). The materials could also be used in conjunction with in-service career development programs. As suggested above, they may also prove useful as "briefing mechanisms" for elected and appointed officials.

SUMMARY OF MODULE COVERAGE

Following this brief overview, chapter two traces the emergence and development of budgeting procedures as a function of government, with particular emphasis on the major shifts in focus and orientation that have occurred in the evolution of budgeting practices. The application of the budget as a mechanism of fiscal control, the management aspects of budgeting, the current search for a long-range planning orientation, and concepts of zero-base budgeting are discussed in this chapter.

As noted at the outset of this discussion, many budget decisions must be made under conditions of risk and uncertainty. Chapter three examines the issues of uncertainty, risk, and innovation in public decision-making and suggests certain fairly simple techniques for reducing the uncertainty that surrounds many public decision situations and for dealing more effectively with questions of risk. The first case study/scenario deals with the use of probability theory and "decision trees" for the organization and analysis of risk components in public decisions. The second case study/scenario focuses on the techniques of sensitivity, contingency, and a fortiori analysis. Both of these case studies draw upon budgetary decision data from the City of Rurbania, the not-so-hypothetical community that provides the data base for analysis throughout this curriculum module.

Chapter four discusses appropriate procedures for effective budget preparation. These systematic procedures are equally applicable to the more traditional forms of line-item/object-of-expenditure budgeting as they are to performance/program budgeting. Techniques for the analysis of revenues and expenditures and for the development and evaluation of service standards are discussed. Various governmental accounting systems, including fund accounting, are identified and their similarities and differences examined briefly. The chronology of the budget cycle, including procedures for the review and approval of the budget document by the legislative body and the appropriate mechanisms of budget administration and expenditure controls, provide a conclusion to this chapter. The case study/scenario deals with the development of a unit cost analysis for annual street lighting maintenance budget in the City of Rurbania.

The major components of a performance/program budget provide the focus of chapter five. While program budgeting has had only limited applications in local government, it is suggested that with appropriate modifications the conceptual framework of program budgeting is perhaps more appropriate to the activities of local government than to other levels of government. A major purpose of this chapter is to develop an understanding of the basic elements of performance/program budgeting and the essential steps in the iterative process of program preparation. The need for a dual budgetary system is suggested in the conclusion to this chapter, and procedures for operationalizing such a dual system are explored through the case study/ scenario on budget crosswalk techniques.

Chapter six examines some of the methods and techniques currently available for application in budget analysis. Techniques of work programming and operations control, including PERT and CPM, provide a focus for the first part of this chapter. The case study/scenario illustrates how these techniques can be used in the planning and scheduling of program activities as part of the budget formulation process. Work programming and operations control are discussed in further detail in the tenth module of this curriculum development series. A brief introduction to the concepts and techniques of cost-benefit and cost-effectiveness analysis serves as the second major component in this chapter, with the final case study/scenario illustrating the consequences of different choice criteria, the impact of opportunity costs, and the feasibility of combined solutions involving mixed strategies. The techniques of cost-benefit and cost-effectiveness analysis are examined in further detail in curriculum module five of this present series.

CHAPTER 2

THE EVOLUTION OF PUBLIC BUDGETING

Public budgeting provides the means by which management information can be organized to make appropriate decisions regarding the allocation of limited fiscal resources. A budget may be defined as: "A comprehensive plan, expressed in financial terms, by which an operating program is effective for a given period of time."[1] A budget should include estimates of: (a) the services, activities, and/or projects that comprise a series of public programs; (b) the resultant expenditure requirements, and (c) the resources available to support these programs. In his definition of a budget, Novick states: "A budget is an estimate of the requirements for a proposed plan of action. Given a stated objective and proposed method for achieving it, all of the steps to be executed are summarized in terms of dollars, an integrated summary, a budget."[2]

OBJECTIVES OF PUBLIC BUDGETING

A budget document provides a common terminology for describing plans and programs covering diverse public operations. It serves as the legal basis for public spending and fiscal accountability. The budget can offer an effective vehicle for periodic evaluations of governmental objectives and can facilitate comparisons of programs and their costs in light of these objectives. Through the budget process, financial authority and responsibility can be delegated, while appropriate central control over these matters is retained.

The purposes of public budgeting are both policy and administration. Far from being merely a financial document, the budget represents a process whereby: (1) public policy is made, (2) action programs are put into effect, and (3) both legislative and administrative controls are established. A budget must be interwoven with and a product of the entire public management process.

Every budget system -- even the most rudimentary ones -- incorporates three basic planning processes: (1) strategic planning, (2) management planning, and (3) operations planning and control. Strategic planning involves an identification of public goals and objectives, determination of needed changes in these objectives, and decisions as to the resources to be used to attain these objectives. It entails the formulation and evaluation of policies governing the acquisition, use, and disposition of public resources. Management planning involves: (1) programming of approved goals into specific projects, programs, and activities; (2) design of organizational units to carry out approved programs; and (3) staffing of these units and procurement of necessary resources. Operations planning and control is the process of assuring that specific tasks are carried out effectively and efficiently. Although most predominant during the execution and audit stages of budgeting, control procedures often determine the form of budget estimates and appropriations.

CHANGING ATTITUDES TOWARD PUBLIC BUDGETING

Contemporary attitudes as to what constitutes prudent fiscal policy differ considerably from those of the past. The proper role of government in providing public facilities and service also has come under considerable reevaluation and redefinition, as has the question of what government can or should do to foster sound economic growth and development. These shifts in attitudes concerning fiscal policy have both resulted in and have been the result of changing attitudes toward public budgeting. As Charles Beard once observed: "Budget reform bears the imprint of the age in which it originated."

Budget reform was closely associated with general reform of local government, especially in the establishment of the city manager form of government. In 1899, a model municipal corporation act, prepared by the National Municipal League, featured a model charter that provided for a budget system. The preparation of the budget was seen as an executive function in contrast to the strong legislative controls exercised at the federal level. By the mid-twenties, most major cities in the United States had some form of budgetary system.

It is possible to identify three successive stages in modern budget reform. In the first stage, dating roughly from 1920 to 1935, the dominant emphasis was on the development of adequate mechanisms for the control of public expenditures. The second stage, beginning with the New Deal era and reaching its peak in the early fifties with the introduction of performance budgeting, provided a focus on management considerations. The third stage can be traced to the current efforts to link strategic planning and budgeting in a multi-purpose mission oriented budget system.

The Era of Fiscal Controls

Historically, fiscal aspects of budgeting have received the greatest emphasis. In most governments, the budget has been considered primarily as a financial and accounting device, with expenditure estimates for various departments and agencies submitted and reviewed in monetary terms. Under this approach, requests are supported by detailing objects of expenditures--tabulations of the myriad items required to operate an administrative unit, such as salaries and wages for personnel, rent, office supplies, equipment, and other such inputs. Technical routines for the compilation and review of estimates and the disbursement of funds are built on these "line-itemizations". The validity of requests are based primarily on comparisons with previous expenditure levels. During the era of fiscal controls, annual balancing of the budget was considered a fundamental principle of sound fiscal policy.

In the early phases of the executive budget movement, objects of expenditure were regarded as subsidiary data to be included for informational purposes only. The Taft Commission, in its 1912 report on the need for a national budget, vigorously opposed appropriations made on the basis of objects of expenditure and recommended that expenditures be classified by class of work, organizational unit, character of expense, and method of financing.[3]

Early efforts to develop functional accounts, however, were relatively unsuccessful. Such accounts, it was held, did not provide adequate protection against administrative improprieties. Therefore, after some experimentation, most budget agencies settled on detailed itemizations of objects which were regarded as desirable ". . . because it provides for the utilization of all the machinery of control which has been provided, ..."[4]

One of the fundamental problems that continues to plague the typical line item budget is the large number of items of appropriation. The Bureau of Municipal Research, in establishing the basis for budgeting in New York City in 1917, proposed a fundamental distinction between budgets and appropriations and the types of information suitable to each. Appropriations were to be used as statutory controls on spending, whereas budgets were regarded as instruments of planning and publicity. Budgets were to include the details underlying plans of work and cost specifications to accomplish this work. Total costs were to be classified by functions in an effort to establish a foundation for appraising results of services rendered. The Bureau recommended the establishment of work programs to provide a detailed analysis of each function, activity, or process within each governmental agency.

This far-sighted conception of budgeting embodied many aspects of a multi-purpose budget system as envisioned in program or mission budgeting today. However, the approach failed to gain acceptance, and the Bureau was left with object accounts oriented to a control function. The distinction between budgets and appropriations was not well understood, and the work program idea was rejected on the ground that it lacked adequate accounting back-up.[5]

By the early twenties, the object-of-expenditure approach to budgeting was widespread. The founding generation of budget personnel concentrated on perfecting this approach with its control orientation. Thus, this era was marked by a preoccupation with forms and factual descriptions of actual and recommended procedures.

As Burkhead has pointed out, object classifications continue to serve certain budgetary purposes well and have two distinct advantages not possessed by other types of budget systems: (1) accountability, and (2) personnel management information.[6] Object classifications establish a pattern of accounts that can be controlled and audited; each object of expenditure is subject to a separate pattern of documentation. The status of existing personnel and proposed changes in personnel allocations are clearly set forth in object classifications. Since personnel requirements are closely linked with other budgetary requirements, the control of positions can be used as a lever to control the whole budget.

Thus, a line-item budget remains a valuable administrative mechanism, providing documentation and accounting of both monies and personnel. A reluctance to give up these administrative controls, in part, has contributed to the resistence to current budget reforms that build on programs or agency missions. These distinct advantages also provide the raison d'etre for a dual budgetary system to be discussed in a subsequent section.

The Management Orientation

As many of the administrative abuses that gave rise to object controls were regulated by statutes and as more reliable systems of accounting were installed, the budget gradually was freed from its "fiscal watchdog" role. The growth of government activities made it exceedingly difficult and costly for central budget officials to keep track of the myriad of objects in the budget. Thus activities began to be aggregated, and increased attention was given to the formulation of management devices for controlling the proliferation of governmental agencies.

Until the advent of Keynsian economics, governmental involvement in economic affairs, at best, was considered a "necessary evil". Little recognition was given to the social value of public expenditures. Outputs of public programs were assumed to have limited and fixed values, and therefore, the budget was used as a central control mechanism in governing inputs. The main function of budgeting was to keep public spending in check.

During the thirties, however, it was recognized that government could increase, as well as redistribute wealth--while at the same time attaining other social objectives--without displacing private investment. As accomplishments of public agencies came to be regarded as "benefits", the task of budgeting was redefined to include efforts to marshall fiscal and organizational resources to attain these benefits.

The scientific management movement also influenced the use of budget processes for the appraisal and improvement of administrative performance. Relevant applications of managerial cost accounting were developed during the thirties in connection with governmental operations. Public agencies sought to devise performance standards, and the rudimentary techniques of productivity measurement were introduced in several federal agencies.

All of these factors converged in the administrative reorganizations that took place in the New Deal years. In 1939, the Bureau of the Budget was transferred from the Department of the Treasury (where it had been established in 1921) to the newly-created Executive Office of the President. This reassignment marked a major shift in the federal approach to budgeting away from the control orientation toward a management orientation. The Bureau staff was increased tenfold, and functions in administrative management and statistical coordination and apportionment procedures for budget execution were added to the Bureau's activities.

By the end of World War II, the management orientation was entrenched in all but one aspect of federal budgeting--the classification of expenditures. In 1949, the Hoover Commission called for modifications in budget classifications to be more in accord with the management orientation. The terminology performance budget first was used by the Commission in recommending the adoption of improved budgetary techniques:

> We recommend that the whole budgetary concept of the federal government should be refashioned by the adoption of a budget based upon functions, activities, and projects; this we designate a performance budget. Such an approach would focus attention upon the general character and relative importance of the work to be done, or upon the

> service to be rendered, rather than upon the things to be acquired, such as personal services, supplies, equipment, and so on. These latter objects are, after all, only the means to an end. The all important thing in budgeting is the work or the service to be accomplished, and what that work or service will cost.[7]

Performance budgeting has a strong management orientation; its principal objective is to assist administrators in their assessment of the work-efficiency of operating units. It seeks this objective by: (1) casting budget categories in functional terms, and (2) providing work-cost measurements and other detailed workload statistics to facilitate more effective performance of prescribed activities. Generally, its methods are particularistic, with the reduction of work-cost data into discreet, measurable units of productivity. As Mosher has stated: ". . . the central idea of the performance budget . . . is that the budget process be focused upon programs and functions--that is, accomplishments to be achieved, work to be done."[8]

Performance budgeting led to the introduction of *activity classifications*. Activities relate to the functions and work responsibilities of distinct operating units; hence their classification ordinarily conforms to organizational lines. Activity classifications gather under a single rubric all the expenditure data needed by an administrator to manage his unit. The evaluation of programs, however, requires an end-product classification that is oriented more directly to the mission and purpose of government. This latter type of classification is of great value to the budget-maker who must decide how to allocate scarce funds among competing claims.

Narrative descriptions of programs and performance also were added to the budget document. These statements give a general picture of the work that will be done by the organizational unit requesting funds. While these narratives have a descriptive and justificatory function, they do not provide an objective basis for evaluating the *cost-utility* of an expenditure. There is little evidence that such narratives have been used for decision-making. Rather, they seem best suited for giving "outsiders" (legislators and the public) some glimpses of what is going on inside an agency.

The Search For A Planning Orientation

The evaluation of program alternatives is an important factor in modern budgeting policy. The same dollar spent on different programs may yield greatly varied results, both in economic and social achievements. Wise budget policy generally seeks to spend public resources where they can produce the greatest net benefits. As Page has observed: "A budget should be a financial expression of a program plan. Setting goals, defining objectives, and developing planned programs for achieveing those objectives are important, integral parts of preparing and justifying a budget submission."[9]

Perhaps the approach that has received the greatest attention (and criticism) in recent years in terms of budget reform is the Planning-Programming-Budgeting-Scheduling System (PPBS). Heralded as an innovation in comprehensive budgeting procedures, PPBS first was brought to public attention in August, 1965, when President Johnson proclaimed that by fiscal year 1968, all Federal departments would adopt the budgeting procedures that has been followed successfully for some years in the Department of Defense.

In spite of the attention that PPBS Systems have received, the fundamental concepts are not radically different from earlier program evaluation methods. As Novick has observed, the concepts of PPBS "have rather ancient and hoary origins."[10] These concepts did not start in the Department of Defense or the Rand Corporation as many have suggested. Rather, there are two basic roots of these methods: one in the federal government, where concepts of a program-oriented budget were introduced as part of the wartime controls systems by the War Production Board in 1941-42; the other root--an even longer and older one--is in private industry. There is evidence to suggest that large corporations, such as DuPont and General Motors, were applying program budget techniques in the early twenties. An as noted previously, a program orientation was reflected in the early model of budgeting procedures advocated by the Bureau of Municipal Research in 1917.

The basic concept underlying program budgeting--that of presenting budgetary requests in terms of program "packages" rather than in the usual line-item format--was adopted as a central focus of PPBS. However, this concept was broadened to encompass a structuring of programs according to objectives regardless of agency responsibility--an "across-the-board" organization and analysis of public programs without concern, initially, for the variety of agencies that might be involved in the process of implementation.

Further, under the PPBS approach, a conscious effort was made to: (1) state end objectives in programmatic terms, (2) seek a wider range of alternatives over a longer time horizon, and (3) link program and financial plans.[11] In short, PPBS gave recognition to the notion that planning and budgeting are complementary operations. These processes constitute the means by which objectives and resources--and the interrelations among them --are taken into account to achieve a more coherent and comprehensive program of action for government as a whole.

While the concept of more rationalistic public budgeting, in the form of PPBS, burst on the scene in the early sixties amid general enthusiasm, heralded by many as the Holy Grail of over a half century of budget reform crusades, the future of these concepts in the seventies remains somewhat in doubt. As with many innovations introduced by dictum, inadequate groundwork was laid for the establishment of PPBS in the federal budgetary process and even less so in state and local governments.[12] What proved to be a highly successful technique in the Department of Defense for the evaluation of weaponry systems had only limited immediate application in other public agencies. Soon, proponents of PPBS were faced with strong arguments concerning its "failures" even in the Defense Department. Much heat but little light arose in the ensuing debates regarding PPBS that took place in legislative chambers, agency conference rooms, and college classrooms.

Whether or not the term PPBS survives this continuing controversy is of little importance. What is significant, however, is that the underlying framework--a more systemic and comprehensive approach to budget-making--be further refined and perfected as an important mechanism of public management. With these objectives in mind, subsequent discussions will attempt to circumvent the PPBS debate by returning to the more basic concepts of performance and program budgeting.

Zero-Base Budgeting

One of the more controversial features of PPBS, and one that may have contributed to its premature demise at the federal level, is the concept of zero-based budgeting. The notion that budgetary requests should be justifield and reviewed in terms of total proposed program expenditures rather than merely the changes from previous appropriation levels is not a new idea. E. Hilton Yong, writing in 1924, called for a justification of public budgets from a zero level of funding. A. E. Buck in 1934 expanded upon Young's earlier advocacy and outlined the rudimentary framework for a zero-base approach to budgeting. The obstacles of unclear intentions, the lack of adequate analytical capabilities, and a general skepticism or outright resistence among public agencies regarding the adoption of more effective measures of performance in terms of client services combined to limit the acceptance and applications of principles of zero-based budgeting in its early formulations.

It was not until 1962 that the concept of zero-based budgeting received application at the federal level, when the budget preparation instructions issued by the Office of Budget and Finance of the U. S. Department of Agriculture stated that:

> All programs will be reviewed from the ground up and not merely in terms of changes proposed for the budget year .... Consideration must be given to the basic need for the work contemplated, the level at which the work should be carried out, the benefits to be received, and the costs to be incurred .... Program goals based on statutes enacted to meet problems or needs that today are of lesser priority must be re-evaluated .... The justification should be prepared on the assumption that all information needed for making budget decisions should be included.[13]

The set of instructions issued by the Bureau of the Budget following President Johnson's August, 1965 declaration did not ecplicitly spell-out the level of detailed sought in program justifications.[14] However, a 1966 supplement to these instructions explained: "It is important that the . . . Program Memoranda be prepared with as much attention paid to reducing and modifying obsolete and low priority programs as expanding others and introducing new ones."[15] The 1967 version of these instructions, while recognizing that in some cases agencies would not be able to provide a thorough justification of their requests in terms of the envisioned zero-base approach, nevertheless stated that:

> The principal objective of PPB is to improve the basis for major program decisions .... The program categories used in each agency should provide a suitable framework for considering and resolving the major questions of mission and scale of operations.[16]

Thus Harty asserted that: "PPBS will . . . tend to lessen the use of the current widespread practice . . . of giving excessive attention to the changes from the preceding year's budget with too little attention to a review of an agency's budget as a whole in the sense of reconsidering the value of existing programs."[17]

The graditional process of budget-building is an accumulative one, whereby each agency advocates its own program requests from a fragmented or "disjointed," rather than comprehensive, viewpoing in terms of overall public goals and objectives. The sum of these disjointed presentations are then added up to form a budgetary whole. Further, the procedure whereby each agency is expected to justify only additional expenditure requirements leads to a kind of incremental "gamesmanship" that has been an accepted part of budget-making for over fifty years. Each agency, in preparing its annual requests for legislative review, adds a fixed percentage to last year's appropriations for various programs to cover the effect of inflation and a fixed percentage to accomodate program growth. Input measures are largely used to "justify: these additional funding requirements, e.g., additional personnel requests. The legislative body, knowing that most agencies are "empire-builders" and, therefore, tend to "pad" their requests, often make across-the-board cuts in program requests to bring the cumulative total more in line with revenue projections and other financial constraints. The agencies, in turn, knowning that the legislative body is going to make such general reductions, do tend to pad their requests in the hopes that the final equilibrium point in this game will leave them with sufficient additional funds to carry out their program mandates and have a little left over for expansion.

Seldom in this budget-making "game" is a serious concerted effort made to examine the base upon which these incremental requests are made --to raise the issue as to the efficacy of established agency programs, many of which may have been "approved" through this disjointed incremental process many years previously. These allocations serve as the base upon which the new increments are built even though their continued validity goes unquestioned. It is to these problems and abuses in budget-making that the concept of zero-base budgeting was addressed.

The benefits of zero-base budgeting are presumed to be an improved framework for decision-making, particularly as related to the allocation of scarce fiscal resources. The working assumption of PPBS, according to Schick, was "that all claims must be pitted against one another,"[18] whether these expenditures demands arise from established or new programs. The anticipated result is "the determination of the proper balance of program efforts."[19] Unfortunately, in the initial formulations of the concept, it is not really clear what quantity and quality of justification and review of a budget request is required in order to have zero-base budgeting. And herein lies one of the basic problems in the application of this concept.

In spite of the fact that nearly half of those participating in the Department of Agriculture's experiment with zero-base budgeting in the early sixties commented quite favorably regarding the experience, "there was widespread agreement that the zero-base budget did not significantly affect outcomes."[20] Many of those who expressed positive attitudes toward zero-base budgeint appear "to have satisfied a longing to believe that they were proceeding according to the canons of rational methods of calculations."[21]

Thus, while zero-base budgeting may provide a catharsis for some of the participants in the process, taken in its more liberal interpretations zero-base budgeting has proven too cumbersome and unwieldy to be operational in most public budgeting systems. Therefore, while it is important to recognize the commendable objectives of zero-base budgeting to curtail or terminate ineffective or obsolete programs, it is necessary to explore some alternative approaches that are more amenable to contemporary budgetary practices. Such an exploration will be discussed in a subsequent chapter of these curriculum materials.

SUMMARY AND CONCLUSIONS

During the past seventy years, there have been a number of significant shifts in emphasis in the processes of public budgeting. With each shift has come a change in the roles and responsibilities of participants in budget-making. The era of fiscal controls produced the line-item/object of expenditure budget which remains a mainstay in the budget-making procedures of many units of government. While criticized for its singular focus on inputs, the traditional line-item budget format has several distinct advantages in terms of accountability and personnel management that should not be totally ignored or discarded in current quests for budget reforms. The management orientation of the thirties and forties yielded the performance budget with its emphasis on efficiency and work-cost measurements. Current and expanding emphases on productivity measurement have given rise to a re-evaluation of the techniques of performance budgeting, several of which have a place in the contemporary search for improved methods of public budgeting. PPBS was a noble experiment in comprehensiveness, giving explicit recognition to the complementary nature of planning and budgeting. Its "failures" should not overshadow the basic objectives that were embodied in its underlying framework, however. While the seeds of zero-base budgeting may have fallen on rocky ground as a consequence of its association with PPBS at the federal level, the critical need remains for some operational procedures that will encourage public officials to identify, and to curtail or terminate ineffective or obsolete programs, as well as providing mechanisms for the more convincing justification of program expansions and enrichments.

Current efforts to develop and implement more systematic techniques to ensure sound policies and decisions in the allocation of public resources has produced the concept of program or mission budgeting.

Program budgeting holds the potential of providing a very useful interface between the activities of long-range planning and decision-making and the day-to-day operations of government. As such, it is essential that public management personnel be fully involved in the further development and sophistication of these concepts and techniques.

ENDNOTES

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19. John Fedkiw and Howard W. Hjort, "The PPB Approach to Research Evaluation," Journal of Farm Economics, Vol. 49 (December 1967), p. 1428.

20. Aaron Wildavsky and Arthur Hammann, "Comprehensive Versus Incremental Budgeting in the Department of Agriculture," in Lyden and Miller, op. cit., p. 153.

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CHAPTER 3

UNCERTAINTY, RISK, AND INNOVATION

Public decisions frequently involve opportunities, risks, and uncertainties. Ris-taking and innovation are inevitable bedfellows. Whenever something new is attempted, the risks involved may include higher costs, reduced efficiency and effectiveness, negative public reactions, or program failure. A risk is taken no matter what the decision; for even if the decision is to do nothing, there is the risk of lost opportunity. One quality of an effective manager is that he is aware of how opportunity, innovation, risk, and uncertainty are interrelated and is willing to take risks appropriate to his level of responsibility.

One manager's uncertainty may be another's risk--what one public manager may interpret as an uncertain situation to be avoided, another may see as an opportunity, albeit evidencing some risk. While these two terms often are mistakenly used interchangeably, the distinction between risk and uncertainty is one of the more important concepts of rational decision-making, and by extension, of public budgeting.

CERTAINTY, UNCERTAINTY, AND RISK

Certainty may be defined as a state of knowledge in which the decision-maker knows in advance the specific outcome to which each alternative course of action will invariably lead, that is, he can predict perfectly (with 100 percent probability) the outcome of the decision. Uncertainty may be defined as a state of knowledge in which one or more courses of action or strategies may result in a set of possible outcomes, but where the probabilities of the outcomes are neighter known or meaningful.

If people are willing to assign objective or subjective probabilities to the outcome of uncertain events, it may be said that such events involve risk. Thus, risk is a state of knowledge in which each alternative leads to one of a set of specific outcomes, each outcoming occurring with a probability (less than one) that is known to the decision-maker. In more succinct terms, "risk is reassurable uncertainty."[1] Risk is measurable when decision expectations or outcomes can be based on statistical probabilities. The event of drawing a red card from a well-shuffled deck is an example of a risky outcome (with a probability of 50%); the event of a Republican President in 1984 is an uncertain outcome (although political soothsayers will attempt to assign subjective probabilities to this event as it approaches).

Probability

The fundamental purpose of establishing probability functions is to bring problems within more manageable bounds by reducing uncertainty to some level of risk that may be tolerated by the decision-maker (depending upon his risk threshold). Probabilities can be established in two basic ways: a posteriori (by induction or empirical measurement) and a priori (by deduction).

The a posteriori approach requires that a sufficiently large number of observation be made to insure stability (that the results are not affected by random events) and that if the experiment is repeated, the same results are likely to be achieved. This approach to probability is most appropriate to controlled experimental or clinical conditions. Under the a priori approach, probability statements are not intended to predict a particular outcome but merely to state that in a large number of situations a particular outcome is likely to occur. In short, a "statistical inference" is made regarding the probable outcome arising from a somewhat uncertain event or series of events.

The concept of personal or subjective probabilities has commonplace application in our daily lives. Whenever we look out the window and say: "There is a fifty-fifty chance that it will rain by noon," or when we observe: "Odds are that three out of four time the light will be red when I get to that intersection," we are using subjective probabilities. By testing subjective probabilities empirically or under controlled experimental conditions, however, decision theorists have been able to arrive at increasingly objective estimates for choice purposes. These refinements, in turn, are finding frequent and increasing applications in decision situations involving the allocation of scarce resources--the budget problem.

Expected Value and Expected Utility

The uncertainty and risk that public administrators face come from two primary sources: the organization itself and the broader environment within which the organization must operate. It is the broader environment over which the administrator has the least control. The sources and types of influences in this broader environment, therefore, often present problems of considerable dimensions in the decision process.

When the environment (including competing strategies) influencing the outcomes of alternative choices is uncertain, an expected value approach often can be employed, i.e., an effort can be made to determine the gains and losses associated with each component of the decision. Expected value is determined by multiplying the value product across all possible outcomes. In mathematical symbols, this may be expressed as follows:

$$EV = p_1\$_1 + p_2\$_2 + \ldots + P_n\$_n,$$

Where p stands for probability, \$ stands for the value of an outcome, and $p_1 + p_2 + \ldots + p_n = 1$. Thus, in order to make a decision, the decision-maker must review the information available on various payoffs arising from choice elements in the decision environment.

This review often is facilitated by the construction of a decision or probability tree (or payoff matrix) that represents combinations of the feasible strategies, the states of nature (with their probabilities of occurrence), and the strategies used. A decision tree is a device used to enumerate all the possible outcomes of a sequence of events, where each event can occur in a finite number of ways.

The construction of a tree diagram is illustrated in the following example. Three field offices--A, B, and C--process 50%, 30%, and 20% of the total number of client applications for assistance from a given public agency. Errors in these applications occasionally require refiling; records maintained over time reveal that the percentages of applications requiring resubmission are 3%, 4%, and 5% respectively. If an application is selected at random, what is the probability that it will contain an error requiring that it be re-filed?

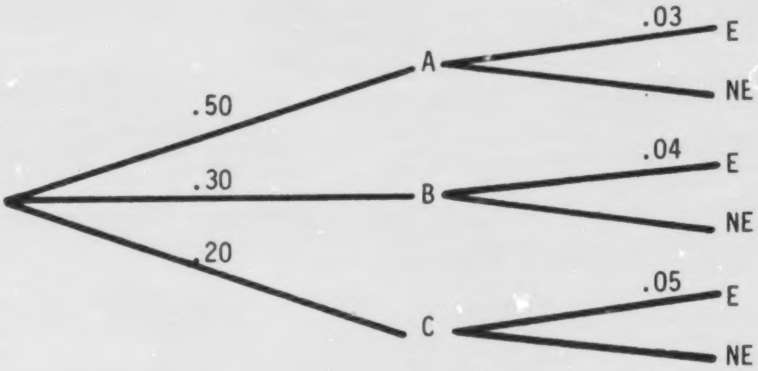

Figure 3-1. A Typical Decision or Probability Tree

The decision or probability tree illustrates the various "paths" that influence the problem outcome. A fundamental theorem in probability theory states that sequential or conditional probabilities (i.e., where the probability of one event occurring is conditioned by the occurrence of a previous event) can be calculated by multiplying the probabilities associated with each event. In other words, the probability of any application containing an error coming from field office A is 0.50 times 0.03 or).015. A second basic theorem is that all probability paths leading to the same outcome are additive. Therefore, the probability of an application with an error being selected from all applications processes by these three field offices is:

$$(0.50)(0.03) + (0.30)(0.04) + (0.20)(0.05) = 0.037 \text{ or } 3.7\%$$

It also is possible with these data to determine the probability that the application requiring resubmission was processed by a particular field office (e.g., office A) by dividing the probability of an application with an error from that office (0.015) by the total probability of an application requiring resubmission being processed (0.037).

The behavior of decision-makers often appears to violate commonly accepted axioms of rational behavior. While no exact probabilities may exist for the success (or failure) of a particular event, as Kassouf has observed, an individual with "clear-cut, consistent preferences over a specified set of strategies . . . will act as if he has assigned probabilities to various outcomes."[2] In short, public officials and administrators make choices based on a set of attitudes built on their experiences and the possible outcomes perceived in light of these attitudes as related to particular problem situations, i.e., they seek to maximize their expected utility.

One of the basic objectives of the more rational approaches to public budgeting is to reduce uncertainty by bringing to light information that will clarify relationships among elements or variables in the resource allocation problem. In so doing, however, the risk associated with a particular choice may remain unchanged; it may decrease (as in the case where a reduction in uncertainty permits more definitive probabilities to be assessed); or it may increase (as where the additional information reveals risk factors previously unknown). Thus, risk and uncertainty, while interrelated, must be treated independently in many decision situations.

There are three distinct levels of uncertainty that must be considered when a decision-maker applies the various tools of rational decision theory. The first category--decision-making under certainty or riskless choice--involves a simple ordering of choices according to some measure of perference. A second level approaches decision-making with objective probabilities and involves a choice among alternatives each of which has a possible (predictable) outcome, each with an associated probability. It is at this second level that the concept of expected value can be applied in conjunction with risk probabilities (objective probabilities). A final level of uncertainty involves decision-making with subjective probabilities, the most common situation confronted in complex social and economic decision situations. In such cases, the attitudes of the decision-makers toward risk-taking and individual preferences (expected utility) play an important role in the decision process.

ECONOMIC MAN VERSUS ADMINISTRATIVE MAN

The field of economics has maintained a prominent role in the formulation of rational models for decision-making, both inthe private and public sectors.

Nearly all economic decision theory is based on riskless choice (decision-making under certainty). The most important set of assumptions made in this theory is that persons faced with decision situations will act as an Economic Man, defined as one who is: (a) completely informed, (b) infinitely sensitive, and (c) rational. Economic Man is assumed to know not only what all the courses of action open to him are, but also what the outcomes of any action will be. The assumption that Economic Man is rational has two important corollaries: (1) Economic Man can rank all of the states (choices) open to him; and (2) he can make his choices so as to maximize (or minimize) something. These conditions assume a complete utility-ordering or preference hierarchy that ranks all sets of consequences from the most preferred to the least preferred. All that is required is for the decision-maker to select the most preferred consequence (in terms of that which he seeks to maximize or minimize).

While Herbert Simon was not the first to be struck by the unreality of the concept of Economic Man, with its attributes of complete information and rationality, he took the lead in offering an alternative model to decision-making--the concept of Administrative or Satisficing Man. Whereas Economic Man is assumed to make decisions as an owner in an environment of predominately small firms in a perfectly competitive market, present-day Administrative Man tends to be a professional manager in an environment fraught with non-perfectly-competitive market conditions. Whereas Economic Man theory is normative (what should be done), Administrative Man theory tends to be descriptive (what is done).

Simon was less concerned with a rational-idealist actor and more with the adaptive behavior of the decision-maker, particularly as he learns from his experiences. Satisficing Man is moved by various motivations to search for alternatives. When he finds an alternative that is "good enough" (i.e., one that suffices) or that resolves his dilemma for the moment, he refrains from further search (i.e., he is satisfied), and thereby he conserves his time, energy, and resources. Simon gives long overdue attention to a second phase of the decision process--the manner in which possible course of action are developed and examined.[3]

Satisficing Man is not necessarily concerned with the "best" or optimal solution, but only with moving toward a better position until such time as he reaches a satisfactory state of equilibrium. Therefore, the path through which Satisficing Man moves with each new piece of information he receives is characterized by considerable trial and error.

Since the elementary components of the problem-solving process (the processes of search and screening), as Simon describes the, are characterized by a great deal of "randomness," a number of writers have interpreted Simon's satisficing model as being without goal identification. According to these interpretations, Satisficing Man reconciles himself to the fact that his choices are bound to be made intuitively and on extrinsic rather than intrinsic bases, since most of the consequences of any choice are incomparable on any operational scale of values.

In many respects, the foregoing is a serious misinterpretation of Simon's conceptual framework. Although Simon tends to be relatively indifferent to high-level goal determining processes, in his discussion of satisficing he makes it clear that one can only speak of an alternative as being "satisfactory" if it meets some set of standards or criteria established prior to selection, i.e., some defined set of goals and objectives.

The satisficing model is not concerned with whether or not men can plan rationally, but only with a sizable portion of behavior that does not exhibit the inherent qualities or rationalities of planning. There is reason to believe that many organizations -- private firms and administrative bureaucracies -- exhibit an optimizing (or rational) model, at least in the short run.

Using the satisficing model requires considerable knowledge of such variables as the values of individual actors, the costs of the "search", the obstacles to the implementation of particular proposals, and so forth. Unless such knowledge is available, the satisficing model reveals relatively little about why any particular actor considered any particular alternative as "good enough".

The relationships between Economic Man, Administrative Man, and the problems of risk and uncertainty are summarized in Figure 3-2. The range of risk between Economic Man (operating under complete certainty) and Administrative Man can frequently be defined in terms of objective probabilities. In this realm, conventional methods of probability theory can be used to reduce uncertainty. The range of risk between Administrative Man and the "Ignoramus" (the individual who operates in the realm of complete uncertainty, often out of an unwillingness to accept any risk) can be defined in terms of subjective probabilities and the methods of statistical inference. The effective manager willingly accepts both the concepts of risk and objective/subjective probabilities.

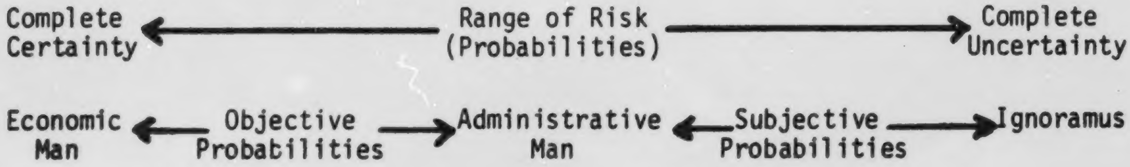

Figure 3-2. The Certainty-Uncertainty Continuum

CASE STUDY #1: DECISION-MAKING UNDER RISK

A recent thoroughfare study undertaken by the Department of Public Safety has revealed that there are five "very high hazard" intersections within the City of Rurbania. At such intersections, there is at least a 10 percent probability in any given week of a traffic accident on Monday, Tuesday, Wednesday, or Thursday, and at least a 20 percent probability of a traffic accident on the heavy traffic weekend days of Friday, Saturday, and Sunday. While these accidents are not normally of major consequence in terms of injuries or deaths, they do result in considerable congestion, personal property damage, and direct public costs (e.g., in terms of police, fire, and rescue squad personnel required at the scene of the accident, damage to public property, and so forth).

As part of his annual request for capital expenditure funds, Dickie John Wagner, Rurbania's City Engineer, has included a $500,000 item for safety improvements at these intersections (improved traffic signal systems, expanded turning lanes, pedestrian overpasses, safety islands, and traffic barriers, etc.). Since it is likely that an expenditure of this magnitude will meet some resistence from members of the City Council in their review of capital construction requests, the City Manager asked Wesley Bellbottom, a Budget Analyst in the Department of Planning and Budget, to work with Mr. Wagner in the development of a further justification in support of this request.

Probability Tree Data

Based on records maintain by the Department of Public Safety, Wesley Bellbottom ascertained that, on the average, each traffic accident day costed the city $200 in direct expenditures. However, if more than one accident occurred in any given week, these costs increased, on the average, by five percent for each additional accident day, e.g., the total cost for two accident days is $420 [($200 + $200)(1.05)], for three accident days, $660 [($200 + $200 + $200)(1.10)], and so forth. Since Mr. Wagner has asserted that the proposed improvements would reduce the probability of accidents at these intersections to a negligible level, Mr. Bellbottom concluded that these public cost factors (as cost savings) would serve as an adequate first approximation of the "benefits" to be derived from the proposed improvements. His problem, however, was to convert these data into annual cost estimates for comparative purposes.

Mr. Bellbottom reasoned that he could use probability theory to construct a payoff matrix for a typical week at a given intersection, and then by multiplying the resulting cost savings figure by 5 (intersections) and by 52 (weeks), an approximate annual cost savings could be derived. The probability tree that would described this problem would have 128 decision nodes.[4] The probability associated with any given path in the probability tree would be equal to the product of the probabilities for each event described by that path. Bellbottom chose to use the minimum probabilities of an accident day (10 percent or 0.10, and 20 percent or 0.20 respectively) in all of his calculations; therefore, the probabilities of no accident for the first part of the week is 90 percent (0.90), and for the weekend, 80 percent (0.80).

The probability of an accident occurring on Tuesday and Friday, with no accidents on Monday, Wednesday, Thursday, Saturday, or Sunday, for example, would be:

(.9)(.1)(.9)(.9)(.2)(.8)(.8) = 0.0093312.

Since the order of accident days is of no consequence in this problem, this figure also represents the probability of two accident days occurring in any given week, where one occurs during the first part of the week and the other during the three-day weekend. Since probabilities in sequenced decision situations are the products of the component events, Bellbottom developed the following table to simplify his calculations.

TABLE 3-1.--Probability of Accident Days in Typical Week

Segment of the Week	Accident Days	Calculations	Probabilities
M.T.W. Th.	0	(.9)(.9)(.9)(.9) =	0.6561
	1	(.1)(.9)(.9)(.9) =	0.0729
	2	(.1)(.1)(.9)(.9) =	0.0081
	3	(.1)(.1)(.1)(.9) =	0.0009
	4	(.1)(.1)(.1)(.1) =	0.0001
F.S. Su.	0	(.8)(.8)(.8) =	0.512
	1	(.2)(.8)(.8) =	0.128
	2	(.2)(.2)(.8) =	0.032
	3	(.2)(.2)(.2) =	0.008

By multiplying the resulting component probabilities, Bellbottom could calculate the appropriate probability for any combination of accident days. For example, the probability of no accidents is (0.6561)(0.512) = 0.3359232; the probability of two accident days, one in the first part of the week and the other on the weekend, is (0.0729)(0.128) = 0.0093312 (as calculated previously); the probability for three accident days, all in the first part of the week, is (0.0009)(0.512) = 0.0004608; and so forth.

The next step in setting up the payoff matrix was to determine the number of paths (frequency) represented by each of the possible set of conditions that might prevail. It would be possible to diagram a probability tree and to count the number of paths represented therein. However, since this would be a somewhat cumbersome undertaking, Bellbottom chose instead to use the theory of combinations and permutations to arrive at these data (see Table 3-2).

With the completion of these calculations, Bellbottom was in a position to construct the payoff matrix (Table 3-2). Using probability theory, he was able to determine that the "cost savings" for a typical week resulting from the proposed improvements would be $208.40. Multiplying this figure by five intersections times 52 weeks, the annual cost savings would be $54,184.

Based on these calculations, it would take over nine years to recover the required investment of $500,000 to make these improvements. During this period, however, the annual costs would increase (due to inflation, etc.). Bellbottom assumed a rather conservative rate of inflation of five percent, and using the standard formula for calculating the impact of a fixed rate of inflation, as shown below, he determined that the cost savings over ten years would amount to $681,520.28.

$$S = N \cdot \frac{(1 + r)^n - 1}{r} = \$54{,}184 \; \frac{(1.05)^{10} - 1}{.05}$$

$$= \$54{,}184 \; \frac{(1.6288944) - 1}{.05}$$

$$= \$54{,}184 \; (12.577888) = \$681{,}520.28.$$

Ratio of Benefits and Costs

Bellbottom next assumed that the $500,000 required to fund the proposed improvements would be financed through a bond issue rather than paid out of current revenues. He suggested that, if a 10 year annuity serial bond were issued, carrying a 4.75 percent coupon rate (interest rate), the annual cost to Rurbania would be $63,968.45, or a total debt service cost over ten years of $639,684.50 (see calculations below).

$$\text{Annual Debt Service} = \text{Principal} \cdot \frac{(r)\,(1 + r)^n}{(1 + r)^n - 1}$$

$$= \$500{,}000 \; \frac{(0.0475)(1.0475)^{10}}{(1.0475)^{10} - 1}$$

$$= \$500{,}000 \; \frac{(0.0475)(1.5905237)}{(1.5905237) - 1}$$

$$= \$500{,}000 \; (0.1279369) = \$63{,}968.45.$$

TABLE 3-2 --Payoff Matrix for Typical Accident Week at Very High Hazard Intersection

Accident Days	Distribution M.T.W.Th.	Distribution F.S.Su.	Probability	Frequency	(P) Total Probability	($) Direct Costs	(P) X ($)
0	0	0	0.3359232	1	0.3359232	$ 0	$ 0
1	1	0	0.0373248	4	0.1492992	$ 200	$ 29.859840
1	0	1	0.0839808	3	0.2519424	$ 200	$ 50.388480
2	1	1	0.0093312	12	0.1119744	$ 420	$ 47.029248
2	0	2	0.0209952	3	0.0629856	$ 420	$ 26.453952
2	2	0	0.0041472	6	0.0248832	$ 420	$ 10.450944
3	1	2	0.0023328	12	0.0279936	$ 660	$ 18.475776
3	2	1	0.0010368	18	0.0186624	$ 660	$ 12.317184
3	0	3	0.0052488	1	0.0052488	$ 660	$ 3.464208
3	3	0	0.0004608	4	0.0018432	$ 660	$ 1.216512
4	2	2	0.0002592	18	0.0046656	$ 920	$ 4.292352
4	1	3	0.0005832	4	0.0023328	$ 920	$ 2.146176
4	3	1	0.0001152	12	0.0013824	$ 920	$ 1.271808
4	4	0	0.0000512	1	0.0000512	$ 920	$ 0.047104
5	2	3	0.0000648	6	0.0003888	$1200	$ 0.466560
5	3	2	0.0000288	12	0.0003456	$1200	$ 0.414720
5	4	1	0.0000128	3	0.0000384	$1200	$ 0.046080
6	3	3	0.0000072	4	0.0000288	$1500	$ 0.043200
6	4	2	0.0000032	3	0.0000096	$1500	$ 0.014400
7	4	3	0.0000008	1	0.0000008	$1820	$ 0.001456
Totals				128	1.0000000		$208.40

Note that in Table 3-2, the frequencies add to 128, as previously calculated, and the probabilities add to 1.0000000, in keeping with the basic axiom of probability theory.

Through these assumptions, Bellbottom was able to bring both the cost savings (or benefits) and the projected cost associated with the improvements to a comparable basis. He then calculated a ratio between cost savings and costs as follows:

$$\frac{\$681,520.28}{\$639,684.50} = 1.0654$$

Since this ratio was greater than 1, he suggested that there was reasonable justification for proceeding with the proposed expenditure for the improvements to these five intersections.

Commentary

Throughout this analysis, Wes Bellbottom chose to make assumptions that would "stack" the analysis against the proposed project. He used the minimum probabilities of an accident day occurring (i.e., 0.10 and 0.20); he included only the direct public costs in developing a "cost savings" base; he used a conservative inflation rate (5 percent) to extend this base over the ten year period; and he selected a relatively low coupon rate in calculating the annual debt service on the annuity serial bond. All of these assumptions were designed to place the results of the analysis in the least favorable light insofar as the proposed project was concerned, on the basis that, if a positive ratio between cost savings and the project costs were attained under these conditions, the project would be on even firmer ground under more favorable conditions. This form of analysis is often used in such situations and is known as a fortiori analysis (coming from the Latin, meaning "with stronger reason").

SCENARIO #1: DECISION-MAKING UNDER RISK

The thoroughfare study undertaken by the Department of Public Safety also identified ten "high hazard" intersections in the City of Rurbania. On any given day of any given week, there is at least a 10 percent probability of a traffic accident at these intersections, the direct public costs per accident day increase as the number of accident days per week increase.

To alleviate the incidence of traffic accidents at these intersections, Dickie John Wagner has proposed two different approaches (combinations of safety improvements), each of which has a different cost and a different projected level of effectiveness. Alternative A would reduce the probability of accidents at these intersections to a negligible level at a cost of $72,000 per intersection. Alternative B would be only 90 percent effective in reducing accidents (at a cost of $63,000 per intersection); under this alternative, there remains a one percent probability of a traffic accident on any given day of the week (i.e., 0.10 times 0.10 = 0.01 or 1%).

Using the data and methodology discussed in the previous case study (or any other approach with which you feel comfortable), your assignment is to determine which of these alternatives (if any) would the Department of Public Safety be justified in pursuing and why. You may wish to develop a payoff matrix for alternative A to determine the level of cost savings achieved by this approach and then assume that the residual costs for alternative B is 10 percent (since this alternative is only 90 percent effective), or you may develop separate payoff matices for each alternative. In comparing cost savings and project costs, you may use the same assumptions as adopted by Wes Bellbottom as to the rate of inflation and the coupon rate on an annuity serial bond.

INSTRUCTIONAL GUIDE #1: DECISION-MAKING UNDER RISK

The primary objectives of this exercise have been: (1) to illustrate how probability theory can be applied to reduce uncertainty in decision-making situations involving risk; (2) to underline the need to bring costs and benefits to a comparable basis for purposes of analysis; (3) to establish a basis for further discussion of distinctions between efficiency and effectiveness in the allocation of scarce resources (i.e., the budget problem); and (4) to identify some of the problems involved in dealing with "residual costs" for solutions that are less than fully effective. Secondary objectives included: (1) an illustration of the concept to a fortiori analysis; and (2) establishment of a basis for the discussion of more refined techniques of analysis beyond crude comparisons of benefits and costs. As a consequence of these objectives, the ratios between cost savings (or benefits) and costs are drawn much closer to unity (i.e., 1.00) and to each other than is the usual case in examples offered to illustrate cost-benefit analysis techniques.

The first step in seeking a solution to the scenaric problem is to construct a payoff matrix for a typical week at a given intersection and then by multiplying the resulting cost savings figure by 10 (intersections) and 52 (weeks) to derive an approximate annual cost savings. The probabilities associated with each possible set of conditions in a given week are illustrated in Table 3-3.

TABLE 3-3 --Probability of Accident Days in a Given Week

Accident Days	Calculations	Probability
0	(.9)(.9)(.9)(.9)(.9)(.9)(.9) =	0.4782969
1	(.1)(.9)(.9)(.9)(.9)(.9)(.9) =	0.0531441
2	(.1)(.1)(.9)(.9)(.9)(.9)(.9) =	0.0059049
3	(.1)(.1)(.1)(.9)(.9)(.9)(.9) =	0.0006561
4	(.1)(.1)(.1)(.1)(.9)(.9)(.9) =	0.0000729
5	(.1)(.1)(.1)(.1)(.1)(.9)(.9) =	0.0000081
6	(.1((.1)(.1)(.1)(.1)(.1)(.9) =	0.0000009
7	(.1)(.1)(.1)(.1)(.1)(.1)(.1) =	0.0000001

Since the probability of an accident is the same for each day of the week (each day of the month, each day of the year), there is no need to separate the distribution as was necessary in the case study.

The frequency associated with any of the possible set of conditions is equal to the factorial of the total number of cases (7! = 5040) divided by the factorial of the number of accident days times the factorial of the number of non-accident days, as shown in Table 3-4.

TABLE 3-4.--Calculations of Frequency of Occurrence

Accident Days		Accident Days	
0	$\frac{7!}{7!} = \frac{5040}{5050} = 1$	4	$\frac{7!}{(4!)(3!)} = \frac{5040}{144} = 35$
1	$\frac{7!}{(6!)(1!)} = \frac{5040}{720} = 7$	5	$\frac{7!}{(5!)(2!)} = \frac{5040}{240} = 21$
2	$\frac{7!}{(2!)(5!)} = \frac{5040}{240} = 21$	6	$\frac{7!}{(6!)(1!)} = \frac{5040}{720} = 7$
3	$\frac{7!}{(3!)(4!)} = \frac{5040}{144} = 35$	7	$\frac{7!}{7!} = \frac{5040}{5040} = 1$

TABLE 3-5.--Payoff Matrix for a Typical Week

Accident Days	Probability	Frequency	(P) Total Probability	($) Direct Costs	(P) X ($)
0	0.4782969	1	0.4782969	$ 0	$ 0
1	0.0531441	7	0.3720087	$ 200	$74.401740
2	0.0059049	21	0.1240029	$ 420	$52.081218
3	0.0006561	35	0.0229635	$ 660	$15.155910
4	0.0000729	35	0.0025515	$ 920	$ 2.347380
5	0.0000081	21	0.0001701	$1200	$ 0.204120
6	0.0000009	7	0.0000063	$1500	$ 0.094500
7	0.0000001	1	0.0000001	$1820	$ 0.000182
Totals		128	1.0000000		$144.20

Note that in Table 3-5, the frequencies add to 128, as previously calculated, and the probabilities add to 1.0000000, in keeping with the basic axiom of probability theory.

The payoff matrix (Table 3-5) shows that the "cost savings" for a typical week resulting from the proposed safety improvements under alternative A are $144.20. Multiplying this figure by 10 intersections times 52 weeks, the annual cost savings would be $74,984. Using the standard formula for calculating the impact of a fixed rate of inflation (5%), the cost savings over ten years would be $74,984(12.577888) = $943,140.35.

The total cost of improvements under alternative A is $720,000. Assuming that this cost will be financed by a ten-year annuity serial bond, carrying a 4.75 percent interest rate, the annual and total debt service can be calcualted as follows:

Annual Debt Service = $720,000(0.1279369) = $92,114.568

Total Debt Service = $92,114.568(10) = $921,145.68.

Through this process, cost savings and projected costs associated with the proposed safety improvements under alternative A have been brought to a comparable basis. The ratio of cost savings to costs, therefore, is as follows:

$$\frac{\$943,140.35}{\$921.145.68} = 1.0238775$$

Alternative B: 90% Effectiveness

Following the procedures outlined above, the total debt service costs associated with alternative B would be $806,002.47 (i.e., $630,000 times 0.1279369 times 10). As suggested in the scenario problem, there are two ways of approaching the calculations to determine cost savings associated with alternative B: (1) to develop a separate payoff matrix to determine residual costs; or (2) to assume that the residual costs for alternative B are 10 percent of the cost saving under alternative A. The results will differ slightly depending on the method used. The second method will be used in this comparison of alternatives because of its simplicity.

Three approaches can be adopted for assessing the impact of the residual costs arising from an alternative that is less than 100 percent effective. The first approach (A) treats residual costs as a reduction in cost savings; the second approach (B) includes residual costs with those costs associated with the proposed safety improvements; and the third approach (C) subtracts residual costs from cost savings and adds these costs to the project improvement costs. While this third approach may appear to be a form of double accounting, it is based on the premise that the residual costs are both a lost opportunity cost and a real cost to the jurisdiction.

$$\text{Residual Costs} = \$144.20(0.10) = \$14.42$$
$$= \$14.42(10)(52)(12.577888) = \$94{,}314.04$$

$$\text{(A)}\quad \frac{\$943{,}140.35 - \$94{,}314.04}{\$806{,}002.47} = 1.0531311$$

$$\text{(B)}\quad \frac{\$943{,}140.35}{\$806{,}002.47 + \$94{,}314.04} = 1.0475653$$

$$\text{(C)}\quad \frac{\$943{,}140.35 - \$94{,}314.04}{\$806{,}002.47 + \$94{,}314.04} = 0.9428087$$

On the basis of this analysis, it may be suggested that alternative B has a slight edge over alternative A insofar as the first two approaches to striking these ratios are concerned. Under the third approach, however, where the residual costs are both subtracted from the cost savings and added to the project costs, alternative A shows a positive ratio (i.e., greater than 1.00), while alternative B does not.

One approach in seeking to resolve this dilemma is to calculate an arithmetic mean of the three cost savings/cost ratios for each alternative. This approach is somewhat analogous to the concept of a sensitivity analysis (further discussed in the next section), in that the ratio under (A) is most optimistic, while the ratio under (C) is most pessimistic. On this basis, alternative A shows the best results, because there are no residual costs associated with this alternatives. The arithmetic mean for alternative A is 1.0239, while for alternative B, it is 1.0145.

"Net Benefits"

As will be discussed further in the subsequent examination of cost-benefit techniques, "net benefits" is the criterion recommended, if not used, most frequently in contemporary cost-benefit analysis in the public sector. Whereas benefit-cost calculations produce a ratio, net benefits measure the difference-- the arithmetic sum--between total costs and benefits. While benefit-cost ratios and net benefits should be calculated on the basis of discounted values, the uniform approach applied to the two alternatives in the present analysis permits a rough approximation of net benefits without discounting, i.e., discounting the stream of costs and benefits would not significantly alter the results in this analysis.

The "net benefits" of alternative B are $42,823.84, whereas for alternative A these "net benefits" are only $21,994.67. This rather significant margin is derived from the considerably lower project cost associated with alternative B.

Cost-Effectiveness

The margin of difference exhibited by alternative B in terms of "net benefits" raises the issue of the cost-effectiveness of alternative A. A cost-effectiveness ratio is analogous to the reciprocal of the benefit-cost ratio. Whereas the benefit-cost ratio has the value of output (benefits) in the numerator and costs in the demoninator, a cost-effectiveness ratio has costs in the numerator and output in physical terms in the denominator.

Since the probability of an accident day is 10 percent for any day of the week, by extension, the probability is 10 percent for any day of the year. In other words, in a typical year there are 36.5 accident days at each intersection or 365 accident days at the ten intersections under study. First examining the project costs without the addition of residual costs, it may be seen that alternative B is more cost-effective than is alternative A.

TABLE 3-6. Cost-Effectiveness of Alternatives A and B

	Accident Days Over 10 Years	Project Costs	$\frac{\text{Project Costs}}{\text{Accident Days}}$
A	3650	$921,145.68	$252.37
B	3285	$806,002.47	$245.36

The issue of residual costs, however, is more readily resolved in cost-effectiveness analysis since these costs are real expenses that must be borne by Rurbania. When residual costs are added to project costs, the cost-effectiveness ratios clearly favor alternative A, as shown in Table 3-7.

TABLE 3-7. Cost-Effectiveness Ratio with Residual Costs

	Accident Days Over 10 Years	Project Costs Plus Residual Costs	$\frac{\text{Total Costs}}{\text{Accident Days}}$
A	3650	$921.145.68	$252.37
B	3285	$900,316.51	$274.07

One final comparison that can be made utilizing the data developed in this analysis involves a comparison of cost savings per accident day averted. As may be seen from Table 3-8, the cost savings per accident averted over the ten years is identical for both alternatives. However, only alternative A shows a positive difference between the cost savings and costs per accident day averted.

TABLE 3-8. Cost Savings Per Accident Day Averted

	Accident Days Over 10 Years	Cost Savings	Cost Savings / Accident Days	Costs Minus Cost Savings
A	3650	$943,140.35	$258.39	+ $ 6.02
B	3285	$848,826.31	$258.39	- $15.68

Concluding Remarks

Based on this extended analysis, it would appear that the City of Rurbanis would be on safe ground in pursuing the safety improvements included under alternative A. The argument can be made that it is impossible to achieve 100 percent effectiveness, and therefore, why not accept alternative B and thereby save the difference in project cost ($115,143.21) between alternatives A and B? Accepting the notion of residual costs as a real cost to the City of Rurbania, however, reduces this difference to $20,829.17. Since alternative A is presumed to avert an additional 365 accident days over ten years, the "cost" per accident day averted beyond the level of effectiveness provided by alternative B is only $57 (i.e., $20,829.17 divided by 365). Or put another way, if alternative A can avert 76 more accident days than alternative B, the City of Rurbania will break even. Alternative A does not have to reach 100 percent effectiveness to improve upon the projected performance of alternative B.

INNOVATION AND UNCERTAINTY

Uncertainty about the future--dominant in most long-range decision situations, particularly those requiring more innovative responses--is often difficult to take into account. In such cases, the use of complicated computational techniques may be little more than expensive window dressing. Several analytical methods have been developed for dealing with this type of uncertainty, however, including: (1) sensitivity analysis, (2) contingency analysis, and (3) a fortiori analysis. These techniques are described briefly in the following sections in an effort to identify their underlying conceptual frameworks and realms of possible application.

Sensitivity Analysis

Sensitivity analysis is designed to measure (often rather crudely) the possible effects on alternatives under analysis resulting from variations in uncertain elements. In most problem situations, there are a few key parameters about which there is a great deal of uncertainty. Analysts must first attempt to determine a set of "expected values" for these parameters, as well as all other more certain or "fixed" parameters. Recognizing that expected values for highly uncertain elements may be, at best, guesstimations, the analyst should use several values (optimistic, most likely, and pessimistic) in an attempt to determine how sensitive the results might be (i.e., the relative rankings of alternatives) as a consequence of variations in these uncertain parameters.

Table 3-9 serves to illustrate how sensitivity analysis can be applied to disclose the variations in rankings among alternatives based on anticipated costs. Two related points concerning uncertainties are illustrated in this table. First, it points up that the range of uncertainty may vary from alternative to alternative. Second, it underlines the fact that the range of uncertain costs may not always be a critical factor in determining the "best" solution. Although uncertain costs exhibit the most narrow range in the case of alternative C (i.e., 15 to 90), this alternative still ranks third except under the conditions of "high" or "pessimistic" uncertain costs.

Contingency Analysis

Contingency analysis is designed to examine the effects on alternatives when a relevant change is postulated in the evaluation criteria. This approach can also be used to ascertain the effects of major changes in the general environment of the problem situation. In short, it is a form of "with and without" analysis. Assume, for example, that the data in Table 3-9 represents the first level analysis of various possible local park sites under existing population distributions and configurations of access route. With a different route configuration, assume that those factors contributing to the high uncertain costs can be reduced by 40 percent, while at the same time, increased population demands are estimated to raise the low uncertain costs by as much as 150 percent (fixed

TABLE 3-9. Illustration of Sensitivity Analysis Under Various Uncertain Cost Levels

Cost Levels	Program Alternatives		
	A	B	C
Expected Value of All Fixed Costs	90	80	100
Low Value of Uncertain Costs	10	30	15
Expected Value of All Costs	100	110	115
Ranking of Alternatives	1	2	3
Medium Value of Certain Costs	60	40	70
Expected Value of All Costs	150	120	170
Ranking of Alternatives	2	1	3
High Value of Uncertain Costs	110	115	90
Expected Value of All Costs	200	195	190
Ranking of Alternatives	3	2	1

costs and the medium or most likely uncertain costs remain unchanged). Operating under these contingencies, the data in Table 3-9 would be converted to that shown in Table 3-10. These contingencies result in shifts in the position of cost factors for alternatives B and C. The "most likely" cost for alternative B in Table 3-9 becomes the low cost in Table 3-10, while the "most likely" cost for alternative C becomes the high cost. The relative rankings of alternative B are improved by these cost adjustments.

TABLE 3-10. Uncertain Costs Under Adjusted Contingencies

Cost Levels	Program Alternatives		
	A	B	C
Expected Value of All Costs at Low Value of Uncertain Costs	115	120	137.5
Ranking of Alternatives	1	2	3
Expected Value of All Costs at Medium Value of Uncertain Costs	150	149	154
Ranking of Alternatives	2	1	3
Expected Value of All Costs at High Value of Uncertain Costs	156	155	170
Ranking of Alternatives	2	1	3

A Fortiori Analysis

A fortiori analysis (from the Latin, meaning "with stronger reason") provides a method of deliberately "stacking the deck" in favor of one alternative to determine how it might stand up in comparison to other alternatives. Suppose that in a particular decision situation the generally accepted judgement before analysis strongly favors alternative C. In performing the analysis of C in comparison to other feasible alternatives, the analyst may choose deliberately to resolve the major uncertainties in favor of C and then determine how each of the other alternatives compares under these adverse conditions. If some alternative other than C looks promising, the analyst may have a very strong case for dismissing the initial intuitive judgement concerning alternative C. Such analysis might be carried out in a series of trials, with each alternative, in turn, favored in terms of the major uncertainties.

While these three techniques for dealing with uncertainty may be useful in a direct analytical sense, they may also contribute indirectly to the resolution of problem situations. Through sensitivity and contingency analysis, for example, it may be possible to gain a better understanding of the really critical uncertainties of a given problem area. With this knowledge, newly designed alternatives might be formulated that would provide a reasonably good hedge against a range of the more significant uncertainties. While this is often difficult, when it can be accomplished it may offer one of the most effective ways to offset the uncertainties of a problem situation.

CASE STUDY #2: SENSITIVITY AND CONTINGENCY ANALYSIS

As a consequence of the rapid growth experienced during the past several years, the City of Rurbania is faced with a need to provide additional office space for various operations of city government, the staffs of which have expanded to meet increasing demands for new and extended public services. At present, the majority of government functions are housed in an annex to the city hall. While the city hall accommodates the municipal court rooms, council chambers, the city library, executive offices (Mayor, City Manager, City Treasurer, City Clerk, and City Attorney), the Police Department, and the jail, a number of agencies of local government are housed in a two-story annex , which provides approximately 24,000 square fee of office space , or are scattered throughout the downtown area in rented office space. The annex is located on a 2.5 acre site which also provides parking for various city-owned vehicles, but only minimum parking facilities for visitors or staff members. Based on a needs study conducted by the Department of Planning and Budget, it has been determined that an additional 12,000 square feet of space is needed immediately and that, over the next five years, the current space should be doubled.

Following discussions with the City Council, the City Manager was given the go-ahead to conduct preliminary site analyses, identifying various alternatives and the probable costs associated with each. Rodney Schmedlapp, a senior planner, was placed in charge of this study, and he and his staff selected three sites for further cost analysis. Architectural consultants were placed on retainer to assist in the development of preliminary design concepts relative to each of these sites.

Site A is an eight acre tract of fairly level land located just outside the central business district, near an interchange to the access highway that connects Rurbania with a major interstate highway. The site is served by sewer and water facilities but preliminary geological surveys suggest that site preparation costs would be highly variable, with estimates ranging from $48,000 to $80,000 per acre.* A "most likely" cost of $62,000 has been suggested by the university geologist who has been asked to consult on this project. Site A offers the advantage of providing for a one-story office building that has the potential for further expansion as the needs dictate. The preliminary design concepts of the architectural consultants envisions a 200 by 250 modular structure (built on a five foot module, with 250 foot dimension fixed), thus providing 50,000 square feet of space in a fairly flexible configuration. Estimated construction costs for this building range from $25 to $36 per square foot (exclusive of internal furnishings), with a most likely cost of $31 per square foot. It has been estimated that this site would cost approximately $12,000 an acre to acquire.

Site B is a six acre tract, with a rolling terrain, located adjacent to a city park, approximately ten blocks from downtown in a section of the city that is experiencing rapid residential development. The site is presently served by city water and could be easily tied into the main sewer collector system. Again, the site preparation costs, based on studies of the university geologist, show a wide range of variation from $45,000 to $95,000 per acre, with a "most likely" cost of $70,000 per acre. The architectural consultants have suggested for this site a two-story building, with 32,000 square feet on the first floor and 16,000 square feet on the second floor. Their design sketches illustrate how the second floor area could be expanded as space needs increase. As a consequence of the two-story design, the estimated construction costs for this approach is slightly higher than for the one-story structure recommended for site A, ranging from $27.50 to $39.00 per square foot, with a "most likely" cost of $32.50. It has been estimated that the site could be acquired for approximately $14,400 per acre.

Site C is located within the downtown area, across Main Street from the city hall. The site is three acres and is presently occupied by a lumber company which has been anticipating a move to a new location. The site has been graded and is used largely for open storage, although there is a small retail outlet which would have to be demolished. It is served by sewer and water. The architectural consultants have suggested that, if this site were to be selected, it would be necessary to build a three-story structure, with approximately 16,000 square feet of usable space on each floor. Construction costs are estimated to range from $29 to $40 a square foot, with a most likely cost of $35 per square foot. Site preparation costs are higher than either site A or B (due to the need to demolish the existing structure), ranging from $80,000 to $146,000 per acre, with a most likely cost of $100,000 per acre. Since the site is owned by the nephew of a member of the City Council, an acquisition cost of $31,000 per acre is deemed to be reasonable.

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*Site preparation costs include clearing and grading, preliminary foundation work, development of parking and storage facilities, landscaping, etc.

After Schmedlapp and his staff completed a preliminary review of these three sites, several members of City Council suggested a fourth alternative, namely the use of the existing 2.5 acre site currently occupied by the administration annex. They argued that, based on the preliminary cost figures, between $86,000 and $96,000 could be "saved" by using this site, since it is already owned by the city, and therefore no acquisition cost would be incurred.

In examining this site, the architectural consultants suggested that it would be necessary to build a four-story structure to provide the requisite 48,000 square feet of usable space (their sketch of a 110 structure actually provides 48,400 square feet), and as a consequence, considerably higher construction costs would be probable, with estimates ranging from $30 to $43 per square foot (with a most likely cost of $37.50). Since the existing annex would have to be demolished, the site preparation costs would be considerably higher than the other three sites; at a minimum $222,500 would be required (or $89,000 per acre). The university geologist pointed out, however, that depending on the load bearing capacity of the site, the cost of site preparation for a four story building might run as high as $178,000 per acre. Preliminary borings taken adjacent to the existing annex led the geologist to suggest a "most likely" cost of $130,000 per acre.

In view of the range of costs for construction and site preparation associated with each of these sites, Schmedlapp decided to undertake a sensitivity analysis. The data that Schmedlapp and his staff analyzed are shown in Table 3-11. The absence of site acquisition costs benefited Site D at the low level of total costs, resulting in this site ranking first ahead of Site B and Site C (Site A ranked fourth at all levels of cost). At the medium or "most likely" level of total costs, Site B moved into first place, followed by Site C and Site D. Site D was adversely affected by the considerably higher construction costs. At the high level of cost estimates (pessimistic), Site C ranked first with with a decisive margin over Site D and Site B. The broad range of uncertain costs for Site B, in large measure, accounted for the significant increase in total costs between the most likely and pessimistic estimates (see Table 3-12).

TABLE 3-11.--Sensitivity Analysis for Four Administrative Office Sites

		A	B	C	D
Dimensions		200 x 250	200 x 160	100 x 160	110 x 100
Stories		1	2	3	4
Square Feet		50,000	48,000	48,000	48,400
Construction Cost/Square Foot	Low	25.00	27.50	29.00	30.00
	Medium	31.00	32.50	35.00	37.50
	High	36.00	39.00	40.00	43.00
Total Construction Costs	Low	$1,250,000	$1,320,000	$1,392,000	$1,452,000
	Medium	$1,550,000	$1,560,000	$1,680,000	$1,815,000
	High	$1,800,000	$1,872,000	$1,920,000	$2,081,000
Acres		8	6	3	2.5
Cost/Acre		$12,000	$14,400	$31,000	0
Total Acquisition Cost		$96,000	$86,400	$93,000	0
Site Preparation Costs/Acre	Low	$48,000	$45,000	$80,000	$89,000
	Medium	$62,000	$70,000	$100,000	$130,000
	High	$80,000	$95,000	$146,000	$178,000
Total Site Preparation Costs	Low	$384,000	$270,000	$240,000	$222,500
	Medium	$496,000	$420,000	$300,000	$325,000
	High	$640,000	$570,000	$430,000	$445,000
Total Costs	Low	$1,730,000 (4)	$1,676,400 (2)	$1,725,000 (3)	$1,674,500 (1)
	Medium	$2,142,000 (4)	$2,066,400 (1)	$2,073,000 (2)	$2,140,000 (3)
	High	$2,536,000 (4)	$2,528,400 (3)	$2,443,000 (1)	$2,526,200 (2)
Expected Value For Equal Probabilities		$2,136,000 (4)	$2,090,400 (2)	$2,080,333 (1)	$2,113,567 (3)
Expected Value For 20-50-30 Probabilities		$ 346,000 1,071,000 760,800 $2,177,800 (4)	$ 335,280 1,033,200 758,520 $2,127,000 (2)	$ 345,000 1,036,500 732,000 $2,113,900 (1)	$ 334,900 1,070,000 757,860 $2,162,760 (3)

TABLE 3-12.--Comparative Differentials from Most Likely Costs

Percentage Difference Between:	Site A	Site B	Site C	Site D
Low and Medium Costs	-19.23%	-18.87%	-16.79%	-21.75%
High and Medium Costs	18.39%	22.36%	17.85%	18.05%

The sensitivity analysis undertaken by Schmedlapp illustrates how uncertain parameters in a decision problem can affect the results under different cost assumptions. Unable to identify an alternative that dominated the analysis at all levels, Schmedlapp elected to undertake a contingency analysis.

The first contingency examined by Schmedlapp and his staff focused on "what if" the three levels of expected values (uncertain costs) were encountered with equal probabilities. As shown in the lower portion of Table 3-11. Site C ranked first under this contingency, followed by Site B and Site C. The difference between Site C and Site B, however, is only $10,067.

The second contingency focused on the "what if" situation where there would be a 20 percent probability of the low or optimistic cost being encountered, 50 percent probability of achieving the most likely cost, and a 30 percent probability of being faced with the high or pessimistic cost. Under these assumptions, Site C again ranked first, with a $13,100 margin over Site B, and a $48,860 margin over Site D.

On the basis of this contingency analysis, Schmedlapp recommended that Site C be selected for further study. He pointed out, however, that although Site A ranked fourth in all cases in terms of total costs, on a cost per square foot basis, it ranked first among the four sites under all conditions studied.

SCENARIO #2: SENSITIVITY AND CONTINGENCY ANALYSIS

While the preliminary analyses reported in the case study were underway, the State announced a new local assistance program, whereby localities would be eligible to receive up to 25 percent state-federal funding (not to exceed $500,000) for construction costs associated with new administrative facilities if provision is made to house the District Office of the State Health Department. It is estimated that an additional 10,000 square feet would be required for these facilities.

If Rurbania is to participate in this assistance program, a number of modifications will be required in the design plans developed for each of the four alternative sites. With site A, the additional 10,000 square feet can be added on to the proposed one-story structure. Due to the modular design and proposed configuration used in this design concept, however, the new structure would be 235 by 250 feet or 58,750 square feet. In the case of site B, the additional space could be obtained by expanding the proposed partial second floor to yield 58,000 square feet of space. Alternatives C and D, on the other hand would require the addition of another floor to the originally proposed structures. Under alternative C, the four-story structure (100' x 148') would provide 59,200 square feet, while under alternative D, the five-story structure (110' x 110') would provide 60,500 square feet.

While these proposed changes would not affect the construction cost estimates for alternatives A and C, the low and medium cost estimates for alternative B would increase by $0.50 per square foot, while the high cost estimated for this alternative would increase by $1.00 per square foot. These increases are the consequence of new structural configuration required for the expanded second story of this structure. For alternative D, on the other hand, the additional story would result in a $1.00 across the board reduction in construction costs per square foot. Acquisition costs and site preparation costs would remain the same for all four sites; these costs would have to be borne totally by the city.

The assignment of this scenario is to determine if it would be appropriate from a cost standpoint for the City of Rurbania to participate in this state-federal assistance program (and thereby receive 25 percent of the construction costs), and if so, how such participation would affect the recommended site(s) under each of the assumptions examined by Schmedlapp in the case study.

ENDNOTES

1. Stephen H. Archer, "The Structure of Management Decision Theory", Academy of Management Journal (December 1964), p. 283.

2. Sheen Kassouf, Normative Decision-Making (Englewood Cliffs: Prentice-Hall, 1970), p. 46.

3. The concept of satisficing was first suggested by Simon in Models of Man (New York: John Wiley & Sons, 1957) and later developed more fully in Organization (New York: John Wiley & Sons, 1958), with James G. March.

4. To determine the number of decision nodes in any probability tree, take the number of choices at each node (in this case, two -- accident or no accident) to the power of the number of decision sequences (in this case, seven for the number of days of the week); therefore, $(2)^7 = 128$.

WORKSHEET

		A	B	C	D
Dimensions Stories Square Feet					
Construction Cost/Square Foot	Low Medium High				
Total Construction Costs	Low Medium High				
Acres		8	6	3	2.5
Cost/Acre					0
Total Acquisition Cost					0
Site Preparation Costs	Low Medium High				
Total Site Preparation Costs	Low Medium High				
Total Costs	Low Medium High				
Expected Value for Equal Probabilities					
Expected Value for 20-50-30 Probabilities					

CHAPTER 4. EFFECTIVE BUDGET PREPARATION

Public budgeting--serving as one of the principal mechanisms for the formulation and implementation of public policy--should be a continuous, dynamic process. A complete budget provides the basis for comparisons as to the relative need for various public services and facilities. It also offers a vehicle for assessing the desirability of proposed services in light of the tax burden required to finance public programs. Publicity on budget decisions furnishes the public with important guidelines in judging the work of both legislative and administrative officials. A well-documented and thoroughly explained budget can inspire public confidence more effectively than any other action taken by a governing body or chief executive.

BUDGETING AS A MANAGEMENT PROCESS

In the process of preparing a budget, the public manager has an excellent opportunity to review the organizational structure and operating methods of public agencies, appraise the competence of agency personnel, and formulate and initiate improvements. Management problems requiring legislative action can be identified and discussed in the budget document. Attention can be focused on the many decisions required to determine appropriate standards of service. The execution of the budget provides one of the most important devices for directing and controlling activities for which public management personnel are responsible.

A budget does not offer any automatic management solutions, however, to the complex problems and issues which surround the control and direction of public affairs. As Mosher has stated: "Budgeting, like other social processes, is a human undertaking, carried on by people who are subject to a wide variety of influences and motivations."[1] Governments do not operate in a vacuum. The budget process always will be affected by political, economic, and social forces originating outside the framework of government in the broader decision environment. Whether budget-makers like it or not, government must be responsive to many of these forces. Public management personnel should be well aware of the limitations of the budget process and the hazards that must be faced.

Classification of Budgets

The term budget commonly is used to identify different aspects of financial planning. A single budget of a given city, for example, could be referred to at one and the same time as: an executive budget, a main or general budget, an annual or current budget, an operating budget, and a lump-sum budget. Classification by types stems from the application of such criteria as:

(1) primary responsibility for preparation (executive or legislative);

(2) organizational comprehensiveness (general budget, special budget, project budget, etc.);

(3) time-span covered by budget document (current or annual versus long-term);

(4) character of expenditures (operating, capital, or emergency);

(5) expenditure classifications emphasized in planning and in appropriations (object or means-oriented versus program or goal-oriented); and

(6) the degree of appropriation breakdown (line-item versus lump-sum).

The current budget generally covers operations for a fiscal year (or in some cases, a biennium) and frequently is referred to as an operating budget. As such, it may be contrasted to the capital budget, which is concerned with public improvements and facilities and with long-term programs of operational services. The capital budget may be adopted as a separate document or may be integrated with the operating budget. The capital budget often is supported by a capital improvements program that covers a period of four to five years beyond the fiscal year. Budgets may also be classified according to the methods used in the balancing of accounts during the fiscal year in which the budget is in effect.

The Budget Cycle

One of the most significant attributes of public budgeting from a management standpoint is that the cycle is repeated every year, thus requiring regular reviews of activities and service policies. The danger inherent in cyclical budgeting, however, is that it can result in short-run thinking and a tendency to postpone necessary expenditure increases or revenue measures to some future budget period. Failure to look beyond the current budget can result in a significant magnification of future problems. The budget for any current cycle inevitably will be affected by past commitments, established standards of service, existing organizational structures, and current methods of operation. Any of these factors may not be entirely satisfactory from the standpoint of effective budget-making. Through cyclical budget analysis, the public manager may find many areas in need of improvement. However, it may not be possible to affect such changes immediately; improvements may have to be programmed over a long period of time.

The budget cycle should cover the full period from initial preparation to final post-audit. Although many local governments adopt a more restricted approach (e.g., fiscal year only), there is little or no opportunity for long-range financial planning under such narrow interpretations, and the potential information feedback from previous fiscal years seldom is used in preparing future budgets. The extended definition of the budget cycle, however, adds the evaluation phase and includes the post-audit not only in a financial sense but also as an evaluation of performance to determine if the objectives identified in the appropriation justifications, in fact, have been accomplished. This approach is in keeping with the concepts of performance budgeting and has given rise to the evaluative mechanism known as the performance audit (the subject of a separate module in the NTDS Urban Management Curriculum Development Project).

Program budgeting adds yet another dimension to the budget cycle in that the requirements of multi-year program and financial plans extends the horizon of the budget analysis to a six or seven year time period. In effect, program budgeting yields an extended budget cycle within a financial planning cycle. As such, this approach provides the optimum level of budget analysis from a management perspective.

FOUNDATIONS OF EFFECTIVE BUDGET PREPARATION

Public budgeting must be established on a firm foundation if it is to provide orderly and regular recurring means for determining and revising public service policies and implementing administrative controls. The success of the public budget process is dependent on many ingredients; among these, the following are particularly important.

Progressive management programs. Basic techniques and activities of progressive public management other than budgeting should also be given adequate attention and development. These would include concepts such as strategic planning and management by objectives to establish a firm base upon which to build the budget through an assessment of long-range goals and objectives of both the community and the agencies of government; productivity improvement measures; and systematic techniques for program implementation and evaluation, including such work programming techniques as PERT and CPM and evaluative mechanisms such as performance auditing. A continuous and comprehensive operations analysis is an essential tool for determining budget requirements. Such management research involves the compilation and analysis of facts concerning governmental operations to be used as a basis for decisions and action programs. In its more advanced forms, such analysis involves the development and maintenance of a management information system. In short, budget making must be based on a continuous scrutiny of services performed, operating methods, organizational structure, and the utilization of public facilities.

Long-range financial plan. The annual budget is only part of the financial planning activities appropriate to effective local government. A long-range financial plan, covering a period of perhaps ten to fifteen years, should include estimates of the jurisdiction's anticipated expenditures for the operation and maintenance of public services and for capital facilities, together with estimates of revenues from all forms of taxes, borrowing, and other sources required to finance these expenditures. Once the financial plan has been formulated, it is carried out with the aid of three administrative devices: (1) a priority list of proposed capital improvements; (2) a capital budget; and (3) the annual operating budget.

Revenue and expenditure analyses. Budgets prepared on a year-to-year basis often fail to adequately reflect forecasts and analyses of anticipated revenues and expenditures. Agencies of local government seldom are required to submit long-term budget projections in conjunction with their funding requests, and as a consequence, there is an insufficient basis for examining the impact of both existing and new programs on future expenditure patterns. Changes in revenue flows or rapid shifts in expenditures for particular services can result in critical financial problems that might have been avoided if such forecasts and analyses had been made.

Inventory of public service activities and standards. Such an inventory must be developed and maintained along with systematic information on the standards of services provided in various public programs, the volume of activities, and program outputs or performance. These records and reports provide valuable data for the preparation of program justifications. While the need for such data is closely akin to the underlying concepts of performance budgeting, the types of measures applied may differ considerably according to the budget format adopted.

Adequate accounting system. The systems of public accounts must be adequate not only for fiscal control but also for the provision of important budgetary information. First priority should be given to the establishment of accounting classifications tailored to local needs. "Model" classification systems should be considered only as guides and must be interpreted in light of the needs of a particular community and its "inventory" of services and activities.

Scheduling procedures, the budget calendar, and instruction forms. Viewed as a process, budgeting may be described as a formalized system of communication. The extent of formalization in the process will vary, depending on the size of the community; the basic outlines of the procedures will be the same, however. Every device of communication--both formal and informal--comes into play, including written instructions, schedules, forms, personal and group conferences, and so on.

Budget review. The budget document must be designed so that it can be reviewed and readily understood by legislators, administrators, and the general public. The legislative body should review the proposed budget in terms of major policies and programs and should not be overly concerned with minor programmatic or financial details. A public hearing on the budget is generally required, and a summary of the tentative budget should be published, together with a notice of the time and place of the hearing.

Budget administration and expenditure controls. When the legislative review is completed and appropriation and tax levy measures for the ensuing fiscal year have been adopted, the budget is returned to the chief executive for execution. Thus, the second half of the budget cycle is initiated. All of the steps taken in the formulation and review of the budget are of relatively little consequence if the financial plan is not administered properly.

LONG-RANGE FINANCIAL PLANNING[2]

A comprehensive development plan can be properly "scaled" only through consideration of the costs associated with its execution in relation to available resources and to ordinary operating and maintenance costs. Without a long-range financial plan, it is difficult to determine if the comprehensive plan is too conservative--foregoing necessary and desirable public improvements and services--or too grandiose--proposing improvements on a scale well beyond public resources.

The major physical facilities required to deliver public services--streets and parking facilities, parks and playgrounds, water, sewage and other utilities and distribution systems, street lighting systems, public buildings, and the necessary major equipment for their operation--comprise the capital plant of any jurisdiction. The initial construction or acquisition, together with improvements and additions to these facilities, are called "capital improvements".

The capital facilities plan consists of a comprehensive listing of capital improvements that are or will be needed by the jurisdiction within some specified time period in order to carry out an agreed-upon program of public services. The capital facilities plan constitutes a bridge between the programs of service, on the one hand, and the comprehensive development plan on the other. The usual practice is to derive a list of capital improvements from a preliminary development plan, to study this list in relation to the public services program and financial plan, and then to employ the revised list in modifying the comprehensive plan.

The more immediate portions of the capital facilities plan generally are developed in greater detail and are incorporated into a six-year capital improvements program that is extended annually by adding to it the project components for another year. In general, six years are required to develop a major facility from initial conception, through preliminary specifications and working drawings, to actual construction (and thus the convention of a six-year capital improvements program). As part of the capital improvements program, the projects to be undertaken are usually arranged in the order of proposed priority of execution, with estimates of the probable cost of each improvement, the method of financing, and other pertinent information. The development of a priority list of capital improvements can be one of the most critical and most difficult phases of the budget process, since various quantitative and qualitative considerations must be brought into play. The authorization of capital improvements, as well as operating and maintenance expenditures, is accomplished by adoption of an annual budget and the enactment of appropriation ordinances. The annual capital budget, therefore, is a one-year "slice" of the long-range capital facilities plan.

ANALYSIS OF REVENUES AND EXPENDITURES

Revenue analysis is a vital phase of budgeting. However, all too often, the budget process is unduly influenced by constraints established through an analysis of revenues, and as a consequence, public programs become a reflection of the funds available rather than true community needs. It must be remembered that, in the long run, revenue totals must reflect expenditure needs. Therefore, a major emphasis in the budget process must be directed toward the estimating of expenditure requirements, particularly those relating to definable public programs.[3]

Factors Determining Public Expenditure Requirements

The fundamental factors that influence program costs include: (1) the scope and quality of services provide; (2) the volume of activity required to render the services; (3) methods, facilities, and organization for performing these activities; (4) qualities and types of labor, materials, equipment, and other cost elements required by public programs; and (5) price levels of the various cost elements.[4] The budget process must be directed to an analysis of these cost conditioning factors as they relate to each program, function, activity, and operation performed. While allocation decisions may be made on programmatic information, budget requests must be supported by the more detailed cost information outlined above. The analysis of cost must be a continuous process, with each annual budget representing only a relatively short time cycle in the life span of the community and its public service programs. An adequate budget system must provide comprehensive and effective procedural devices for controlling expenditures and thus establishing the price citizens must pay for public services.

Estimating Budget Revenues

Revenue estimates should receive the same careful consideration as the expenditure side of the budget. Estimated receipts from present rates of taxes and miscellaneous charges must be calculated after a thorough analysis of collection trends and conditions affecting the yield from each source. The rates of all service charges must be compared to changes anticipated in the cost of rendering services and consideration must be given to possible adjustments in rate sch edules. If projected revenues are inadequate to finance the expenditure program proposed, consideration must be given to: (1) further reductions in expenditures; (2) changes in existing rates of taxes and charges; and (3) adoption of new types of revenue sources.

Each source of revenue may require a different formula in order to forecast a reliable estimate. Some revenues may produce practically the same amounts from year to year; other revenues fluctuate significantly and cannot be relied upon to yield the same levels from one year to the next. However, for each revenue source, there will be a rate of charge and an item subject to levy of tax, license, or change. The yield must be estimated by determining how frequently the item subject to tax will occur. No source of revenue should be estimated solely upon collections of the previous year, however. Some revenues are more stable than others; but high stability should not lull the manager into the pitfall of routine estimating.

ANALYSIS OF SERVICE STANDARDS

One of the most important factors in determining public expenditure requirements is the range and quality of services to be provided. A large part of the management process must be devoted to an evaluation of service standards and a search for better methods for accomplishing program objectives. It is inevitable that judgments be made as to the comparative values of various public services currently provided or proposed.

Decisions on standards of service and judgments concerning effectiveness of performance must be made regardless of the budget format adopted. Where a strict "fiscal" approach is followed, budgets all too often are built primarily on the basis of a review and projection of past expenditure trends. Unfortunately, data on the flow of dollars in and out of the public coffer provide very little objective information for making all-important service decisions. Where the philosophy of performance or program budgeting prevails, emphasis is placed on analysis of the underlying factors, such as service standards, which will determine the flow of dollars. In planning a program to improve budgetary techniques, initial emphasis must be given to the preparation of an inventory of activities or functions classified by programs, with a description of facilities and methods used in program accomplishment.

Inventory of Activities and Standards of Service

To be of maximum value, the inventory of activities must be comprehensive. It should include systematic compilation of pertinent information relating to objectives, means, and methods of accomplishment for each public service activity. The inventory process also should include a search for clues to the measurement of performance and volume of activities. Once the inventory has been completed, it can be kept up-to-date relatively easy as part of the annual budget process.

An inventory of public activities will provide a clear picture of present service standards and methods, but it provides no automatic formula for determining appropriate service standards for the future. Final decisions on such standards are properly the responsibility of elected officials. However, public management personnel must assume the responsibility for furnishing full information concerning services currently performed, results achieved, probable long-term results, and cost of additional services, and for recommending changes in public programs when desirable.

Comparisons of service levels with those of other localities and with "model" standards may be helpful. While such comparisons never can be taken as conclusive dur to local variations, frequently they raise important questions and thereby bring to light instances where local service standards are either too high or too low.

Estimates of Volumes of Activities

A major factor in determining cost is the volume of activity involved in delivering a given public service at the standard of quality desired. Therefore, attention must be given to the development of record and reporting systems that will provide reliable data on the volume of activities. A variety of methods has been developed for compiling such data and relating these measures to expenditure estimates.[5] Each of these methods is equally valid, and each should be utilized where appropriate in order that the volume of activity can be analyzed properly. Further refinements are possible where cost accounting procedures have been installed or where techniques have been established for converting volume standards to uniform units of personnel and materials.

Activity/Program Analysis in the Annual Budget Process

The inventory of activities and the analysis of these activities in programmatic terms are basic to the development of a sound annual budget. When the initial survey has been completed, each distinct program (cluster of activities) should be identified and briefly defined in descriptive terms. Performance measures (workload measures, unit cost data, etc.) and measures of effectiveness should be formulated for each program. In the case of major programs, it may be desirable to break down activities into subactivities. Budget estimates should be prepared for each activity or subactivity, along with supporting data on program performance.

Refinements in estimating methods can only be accomplished over a more extended time period as progress is made in long-term analysis of methods of operations and as agency heads become further skilled in such management techniques. Nonmeasurable activities always will remain and must be evaluated primarily through the descriptive type of analysis. Even for measurable activities, data on the volume of activity cannot be used as the only determining factor until sufficient research is completed to validate the significance of the data and to establish standards for the cost estimates based on actual performance.

GOVERNMENTAL ACCOUNTING SYSTEMS

To fully comprehend the appropriate structure of accounting systems in local government, it is first necessary to understand the principal operational objectives of such systems.[6] A good accounting system must provide a basis for:

(1) Accountability by public officials and public service personnel for the local government resources for which they are custodians or managers.

(2) A system of controls in relation to the use of funds and property in accordance with laws, local ordinances, and other rules and regulations governing the expenditure and use of public resources.

(3) Reporting to other administrative officials, the governing body and the general public concerning the exercise of this stewardship.

(4) Providing information in a form, frequency, and timeliness required for management decisions and for the supervision of programs and activities.

(5) Providing accurate and timely information to creditors (bondholders and others) as to the financial status of local government.

(6) Providing current information concerning the cash flow of municipal enterprises.

The design and operation of an accounting system which performs these manifold functions in a satisfactory manner is indeed a major contribution to the successful financial management of any local government.

Fund Accounting

Transactions within local governments are recorded through a series of funds--accounting entities that embody a whole group of self-balancing accounts (balance sheets and operating statement accounts). These records of resources, transactions, and statements of assets and liabilities provide the means of "tracking" revenues and expenditures through the fiscal activities of government, forming the basis for procedures of fund accounting, one of the dominant forms of governmental accounting.

The budgetary and accounting requirements of these various funds can be summarized by considering the following four general groupings of funds:

(1) Funds concerned with current governmental operations--general fund, special revenue funds, debt service funds, and certain expendable trust funds--tend to emphasize currently appropriated monies, with fixed assets and long-term liabilities excluded from their balance sheets. Modified accrual or encumbrance basis of accounting often is used in conjunction with these funds in which liabilities for expenditures are recorded as they are incurred, but most types of revenues are not recorded until actually received in cash. This approach results in a rather conservative estimate of the balance currently available for approved activities.

(2) Funds concerned with capital spending include the capital project funds and the special assessment funds. The ordinances that create these funds usually include budgetary restrictions, but these funds typically are not included in the annual appropriation ordinance.

(3) Commercial-type funds record activities that are expected to earn a profit or at least recover costs, and include enterprise funds, intragovernmental service funds, and trust funds concerned with investing principal to earn an income. These funds have complete balance sheets, including fixed assets and long-term liabilities. Revenues and expenditures are recorded on an accrual basis. The budgets of these funds serve as guidelines for operations rather than as legal limits on expenditures. There is little difference between the accounting for these funds and that for private sector commercial enterprises.

(4) Custodial funds are simply self-balancing liability accounts showing assets held for others; agency funds are the main example. No budgetary controls are necessary for such funds.

Budgetary Accounting

For those funds concerned with current governmental operations, the control obtained through fund accounting is strengthened by a budgetary accounting system. Under this approach, the budget is viewed as both a mandate for and a limit on expenditures. In most cases, the actual spending should coincide quite closely with budgetary appropriations. In effect, appropriations represent the legal authority to spend. Such authorization, however, is viewed in budgetary accounting as being very specific in terms of the amounts to be spent and the items required for each agency's operations. Therefore, the first accounting entries for the operating cycle formally record the newly adopted budget in detail according to the various accounts.

Good budgetary accounting includes provision for a system of encumbrances that records against an appropriation the placement of purchase orders or the letting of contracts. Thus the basis for accounting is when an obligation is first incurred. When the item is delivered and paid for (or the contracted service provided), the expenditure is recorded and the encumbered amount is liquidated. At any point in time, the account balance shows the original amount budgetted minus actual expenditures and encumbrances. While the amount originally encumbered need not be exactly equal to the actual expenditure, encumbrances should be estimated as closely as possible.

A personnel plan usually accompanies the budget and contains established salary scales and other built-in limits for personnel support expenditures, and therefore, these funds need not be encumbered. Detailed line-itemization and object of expenditure codes provide the foundation for budgetary accounting.

Managerial Accounting

Although conventional forms of financial accounting have always served management, a relatively new approach further shifts this emphasis by adding new substantive dimensions to the accounting system. The managerial accounting approach places greater emphasis on the production of information for planning and programming purposes, thus seeking to establish a balance with the control functions of accounting. Managerial controls are added, centering on performance standards and the development of internal reports which highlight significant variances from such standards. The emphasis of managerial accounting on performance standards and unit cost data and the identification of cost and responsibility centers generates greater cost-consciousness among operating agencies. This cost approach is linked with decision-making and, often, with performance/program budgeting and the procedures of performance auditing.

Managerial accounting often is tied into (or is the product of) management by objectives (MBO) techniques. MBO, in turn, requires a management information and program evaluation system (MIPES) that permits decision-makers to anticipate questions they must resolve and to focus information so as to facilitate solutions. The managerial approach is relatively new in public sector applications and will not supersede financial accounting systems. Rather it is a supplemental and complementary means of organizing and analyzing financial data and performance indices in a management context.

Cost Accounting

Although establish in the accounting procedures of some local governments for many years, cost accounting often is discussed as a subset of the managerial accounting approach. Undoubtedly, the expanding focus on such concepts as program or mission budgeting, zero base budgeting, productivity measurement, and management by objective has provided a renewed interest in the techniques of cost accounting.

Cost accounting is the process of assembling and recording all elements of expense incurred in attaining a purpose, carrying on an activity or operation, completing a unit of work or doing a specific task. While general accounting systems are used to record the financial transactions of a jurisdiction, cost accounting is used to determine the total and unit costs of various activities. Cost accounts sometimes are maintained independently of the general accounting system, but it is usually essential that they be made subsidiary to the general accounts.

While both general and cost accounting include an analysis of the expenses of a jurisdiction, cost accounting carries this analysis further by providing for a measurement of work accomplished and relating the expenses of that work through a calculated unit cost. The main purposes of cost accounting are as follows:

(1) Protection against loss, waste, and inefficiency through comparisons of unit costs with past performances and established standards to reveal opportunities for economies in operation.

(2) Provision of data for policy determination as to the advisability of certain expenditures and the choice among alternatives when there are several possible methods of accomplishing a given task.

(3) Assistance in determining prices and rates in conjunction with special fees, interdepartmental charges, support of grants or reimbursements from other agencies, and so forth; public utilities, in particular, require accurate unit cost information in setting their user fees.

(4) Provision of budgetary controls for public expenditures by establishing work programs and by providing estimates of future costs of activities.

(5) Increased motivation and efficiency of work crews through the use of service ratings based on unit cost data as a tool for personnel management.

(6) Furnish data for relating performance to expense in public reporting on governmental operations.

There are no hard-and-fast rules for establishing unit cost standards; cost standards are local in their application and will differ in accordance with different conditions, problems, methods, and prevailing wage rates. Cost standards should reflect the mix of the four basic elements of cost--labor, materials, equipment, and overhead--that enter into a given operation or job. Cost standards should be reviewed from time to time and revised whenever they are found to be inconsistent with prevailing practices. Changes are needed when a new method or modification in policy is introduced, when wage rates or material costs change, and when there are significant changes in the efficiency of an operation. The case study/scenario at the conclusion of this chapter illustrates the potential application of these cost accounting techniques to the building of a budget request for a typical operation of local government.

THE BUDGET CALENDAR AND OPERATION SCHEDULES

Budget-making requires careful scheduling if public officials are to be given adequate time and complete information for sound decisions on budget policy. If the mass of detail required is to be coordinated and if deadlines are to be met, all the steps in the process must be taken in logical sequence, and the responsibility for performing each step must be clearly assigned. To insure that requests are submitted in a uniform manner, it is essential that well-designed forms be provided. It also is desirable that policies and special instructions for the guidance of agency heads be set forth specifically in writing.

A budget calendar should be established in advance and should set forth, in chronological order, the key dates and assignments of responsibilities. At the local level, the controlling dates of the budget calendar often are set by state law, city charter, or ordinance and serve as deadlines for submission of the budget to city council, for its adoption, and for setting the annual property tax levy and rate.

The budget calendars suggested on the following page are based on a fiscal year starting on January 1, with property taxes falling due on the same date. The actual dates, of course, will have to be adjusted to the fiscal year of the municipality. The total time for the annual budget preparation will vary from four to six months in a large city to two to three months in a small city. The time interval allowed for each step will vary somewhat in accordance with the size of the municipality and legal requirements.

REVIEW AND PRESENTATION OF THE BUDGET

In all likelihood, the total requests from individual agencies will exceed the ability of the jurisdiction to finance these programs. The final step in the budget-making process, therefore, is to interface all elements of the budget, that is, to review and revise programs and dollar estimates of expenditures and revenues. This is perhaps the most important task in the budget process-revising the estimates, tying unrelated programs into a balanced whole, and eliminating unnecessary or low priority proposals--a critical process of evaluation, where the pros and cons of one activity must be balanced against another, and where some worthwhile programs may have to be revised or even dropped entirely.

The Budget Document and Message

The final budget document should provide a clear picture of both the programs to be carried out and the financial basis to support these activities. The enthusiasm of technicians for complete detail often must be curtailed somewhat in the interest of clarity and simplicity. Simplicity can be achieved, however, without omitting important facts by a well-constructed budget message, by choosing summaries carefully, and through the use of charts and tables to explain service programs.

SUGGESTED BUDGET PREPARATION CALENDARS FOR LARGE AND SMALL CITIES

Time Period		Budget Requirement	Responsible Official
Large City	Small City		
Feb. 1-July 1	June 15-Aug. 15	Preparation of long term program of services and capital improvements	Chief administrator and dept. heads
Prior to July 15	Prior to Aug. 15	Preliminary work, including entering prior and current year financial data on estimate forms and preliminary revenue estimates	Chief finance officer and budget officer
July 15	Aug. 15	Issue budget instructions and estimate forms	Chief administrator
July 15-Sept. 1	Aug. 15-Oct. 1	Prepare work program and budget estimates	Dept. heads
July 15-Sept. 1	Sept. 22-Oct. 1	Prepare revenue estimates	Chief finance officer and budget officer
Aug. 15-Sept. 7	Oct. 1-Oct. 15	Check mathematical accuracy of estimates, compile, and summarize	Chief finance officer
Sept. 1-Oct. 15	Oct. 15-Nov. 15	Investigate and review requests; determine final recommendations	Budget officer and chief administrator
Oct. 15-Nov. 1	Nov. 5-Nov. 15	Prepare budget document	Chief administrator & budget officer, chief finance officer
Nov. 1	Nov. 15	Submit budget to city council	Chief administrator
Nov. 1-Nov. 22	Nov. 15-Dec. 1	Legislative consideration of budget	City council
Nov. 7-Nov. 15	Nov. 19-Nov. 23	Public budget hearings	City council
Nov. 22	Dec. 1	Budget adoption by enactment of appropriation and revenue ordinances	City council
Nov. 22-Jan. 1	Dec. 1-Jan. 1	Prepare and mail tax bills	Finance dept.
Dec. 15-Jan. 10	Dec. 15-Jan. 5	Prepare, review, and establish budget allotments	Dept. heads and budget officer
Continuous	Continuous	Budget administration and management research	All administrative & staff officials

The chief executive's budget message is the primary vehicle for conveying a clear understanding of the problems to be faced in implementing the budget. The message should outline the fiscal policies proposed and the basic premises underlying the estimates. Major changes recommended in public services should be noted, and important changes in program objectives, costs, revenues, and financial trends should be explained. Reference should be made as to the relationships between capital outlay items in the proposed budget and the long-term capital improvements program. To add emphasis, a few carefully selected charts, tables, and graphs may be interspersed within the written text. Brief comments may be made in the message concerning some important items of increase or decrease in agency budgets. The budget message, however, must be concise and designed to maintain reader interest. The purely monetary side of the budget should be set forth in summary tables which follow the message.

Summary Statements and Detailed Budget Estimates

A series of summary statements of revenue and expenditures should follow the written budget message. The exact form of these statements will vary, depending on the legal funding structure of the jurisdiction. Among the more commonly used summary statements are the following:

(1) General Budget Summary: preferably a one page statement indicating the balance between proposed expenditures and resources; this statement may be divided into several sections, one for each fund.

(2) Summary of Expenditures: provides a summary breakdown of expenditures by program, function, agency, and fund.

(3) Summary of Property Tax Revenues: shows a tabulation for several years of important data concerning property taxes, including assessed valuation by class of property, tax levy, tax collections, distribution of receipts by funds, and details of tax rate.

(4) Summary of Miscellaneous Revenues: shows tabulations for several years of revenues collected and analyzed by source and by fund.

(5) Bonded Indebtedness Statement: shows data concerning amount of bonds outstanding, bonds authorized and unissued, condition of sinking funds, and analysis of legal debt margin.

Part II of the budget document, which follows the section containing the budget message and summaries, gives a detailed analysis of each agency's programs and expenditure requests. The amount of detail and form of presentation varies a good deal depending on the desires of the budget makers and, to some extent, on legal requirements.

Publicity on the Budget

The first publicity should be given the budget when it is submitted for legislative review. After it has been transmitted to the governing body, sufficient copies of the budget document should be distributed to newspapers, libraries, and civic organizations. A limited number of copies also should be available for citizens who request them and extra copies should be on file for public inspection. The budget message and summary sections often are printed in adequate quantity for wide distribution. These sections of the budget can be passed out to persons present at public meetings on the budget.

Even though public hearings are widely publicized to insure all citizens have adequate opportunity to present their views, such hearings seldom have proven successful in ascertaining the attitudes of the general public on specific proposals outlined in the budget. Relatively few citizens attend these hearings unless a group is irate over some aspect of the budget. Too often, the only nonofficials in attendance are representatives of taxpayers' organizations and vested interest groups pushing their pet projects. Officials should be prepared for abrupt surprises, however. Citizens may decide to attend the hearings, and public officials must be ready and able to answer any questions.

Legislative Action on the Budget

Following the public hearings, the budget should be discussed by the governing body in executive session in an effort to reach agreement upon an overall budget program. Every effort should be made to provide the members of the governing body with a full understanding of the budget in terms of the public programs and policies which it represents. Legislators should receive more than a thick book, with pages upon pages of tables, providing little or no explanation of the services or the intent of the administration. Under such circumstances, members of the governing body may feel obliged to check details of expenditures, such as the amount for pencils, cost of paper, and so forth. Such "knit-picking" over details arises out of an absence of any broad explanation of the public programs to be undertaken As a result, important policy decisions involved in setting the level of public services may never be faced directly.

In some jurisdictions, budget appropriation and other measures must be adopted in ordinance form; in others this is accomplished by resolution. Appropriations should be in lump-sum form to each agency for current expenditures and for capital outlay. Further details, of course, will appear in the budget document to support and explain the items in the appropriation ordinance or resolution. These detailed items need not, and should not, be written into the appropriation measure. The governing body should be empowered to reduce appropriations during the year or to transfer unencumbered balances from one appropriation to another. Except for expenditures from the emergency appropriation and large contracts requiring specific legislative approval, all appropriations should become available for expenditure at any time at the discretion of the chief administrator without further action by the legislative body.

BUDGET ADMINISTRATION AND EXPENDITURE CONTROLS

An effective system of budgetary controls must be established to properly implement the budget. Such a system should be built around two essential elements: fiscal control and management control. Effective fiscal control involves: (1) an allotment system for all expenditures from appropriations; (2) adequate appropriation and expenditure accounting; and (3) frequent and regular financial reports on receipts and expenditures from each fund. Management control involves: (1) cost and performance control procedures; (2) performance reporting and auditing; and (3) continuous operations analysis and management research dealing with work methods and organization.

In the final analysis, costs must be controlled at the point of origin. The devices of budget administration, such as the allotment system, procedures of budgetary accounting, and the many management control procedures, will be of limited value without full understanding and active cooperation of operating supervisors. Indeed, excellent cost control procedures improperly administered can quickly degenerate into burdensome "red tape" rather than serving to expedite action and improve the quality of administrative decisions.

CONCLUDING REMARKS

An attempt has been made in this discussion to integrate established procedures of more traditional forms of budget making with the underlying concepts of performance/program budgeting. The procedures set forth, however, are not dependent upon a highly developed capacity for program analysis based on techniques of cost-benefit or cost-effectiveness analysis. At the same time, these more sophisticated techniques could be applied within the framework outlined; thereby, making possible an orderly transition from more traditional approaches to budgeting to the more comprehensive and systamatic approaches envisioned in performance/program budgeting.

CASE STUDY #3: UNIT COST ANALYSIS

Several neighborhood groups have recently petitioned the City Council of Rurbania for an up-grading of their street lighting systems, suggesting the replacement of conventional incandescent lights with mercury vapor lamps similar to those currently in operation in some of the commercial districts of the city. The City of Rurbania is eligible to participate in a federal program under the Safe Streets Act through which all incandescent street lights in the city could be replaced by mercury vapor lamps, with 25 percent of the conversion costs to be borne by the city. The City Engineer and the Public Works Director have estimated that the total cost of this conversion program would be $480,000. To justify participation in this program, the City Council has asked that some assurances be given that such a program would result in an appropriate cost savings over the first four to five years of operation to warrant the initial investment of $120,000 of city funds (i.e., that a benefit-cost ratio of at least 1.0 could be attained in the first four to five years of operation).

To provide such assurances, the City Manager asked Tobias Todarol, a budget analyst, to develop cost data on the current operations of the street lighting system and to formulate a cost comparison of these current figures with projected operating costs for the new system. In the process of developing these data, Todarol decided that it would be useful to prepare overall cost accounting information on the total operations of the city's annual street lighting maintenance program.

In discussing the problem with the Director of Public Works, Todarol learned that mercury vapor lamps, while more expensive, need to be replaced under normal maintenance procedures only every three years, whereas incandescent lamps must be replaced with the following frequencies:

(1) lamps that burn from dusk to midnight: every eight months;
(2) lamps that burn all night: every four months;
(3) multiple lamps (two or more lamps per pole): every two months.

Each time an incandescent lamp is replaced through this preventive maintenance program, the maintenance crew also washes the luminaries (reflectors); mercury lamps are self-contained, i.e., they do not have separate reflectors. The Public Works Director also pointed out to Todarol that the maintenance records show 15 percent of the incandescent lamps and 10 percent of the mercury vapor lamps must be replaced before the normal maintenance period due to early burnouts, i.e., lamps must be replaced between normal maintenance periods even though they are replaced again according to the established preventive maintenance schedule.

Light standards must be repainted every other year, and as the Public Works Director pointed out, these standards must be repaired from time to time. The circuits within the cable system must also receive periodic repairs, wind damage to the standards occurs with some frequency, and other types of maintenance must be made as required.

In checking the records of the various maintenance crews, Todarol determined that over the past several years ten percent of all light standards over 18 feet in height have required some form of annual maintenance, while 30 percent of the light standards under 18 feet in height required some form of repair each year. Of the 500 circuits in the cable system, 80 percent require some form of maintenance each year. Wind damage results in replacement of five percent of all light standards annually, and some 200 man-hours are required each year for miscellaneous maintenance of the street lighting system in the City of Rurbania.

Todarol's next task was to develop work unit costs for each of these operations. In discussing the problem with crew leaders, he determined that, on the average, a crew member can replace five incandescent lamps per hour or two mercury vapor lamps per hour. On the average, two men can wash ten luminaries in an hour. It takes 4.5 man-hours to paint each light standard that is over 18 feet in height and about 3 man-hours to paint a light standard under 18 feet. Average maintenance time on light standards over 18 feet has been two man-hours per standard requiring repairs, while one and a half man-hours have been required for maintenance of each of the standards under 18 feet that have required repairs. Damage repairs have been quite time consuming, requiring on the average 30 man-hours for each replacement, while repairs to the cable system, on the average, have required 10 man-hours for each operation.

In checking with the Payroll Department, Todarol determined that members of the maintenance crew responsible for replacing lamps and washing reflectors receive $3.50 per hour. The painters receive $4 per hour, while the crews that maintain the standards receive $3.60 per hour. More senior personnel are required for major repairs, including pole damage, cable repairs, and maintenance not otherwise classified; these senior crew members receive $4.50 per hour. Todarol now had the necessary information to fill in the first three columns of Table 4-2 on the following page.

Tobias Todarol's next task was to determine the unit cost data for materials and supplies used in the various operations of the street lighting maintenance crews. From the records of the city's central stores, he determined that incandescent lamps cost $2.10 each and that mercury vapor lamps cost $11.75 each. Materials used to wash luminaires (soap, cloths, etc.) cost, on the average, $16 per day for each two-man crew. The paint used costs $9 per gallon; previously Todarol learned that a gallon of paint will cover 12 standards over 18 feet or 18 standards under 18 feet. Each pole that must be replaced due to wind damage costs $110. The average cost for materials for cable repairs has been $26 per operation.

Table 4-2.--Unit Costs for Street Light Maintenance Report

Operation	Unit Man-Hours	Rate per Man-Hour	Unit-Labor Cost	Unit Materials	Unit Equipment	Total Unit Costs
Replacement of Lamps						
Incandescent	0.20	$3.50	$0.70	$2.10	$0.35	$3.15
Mercury Vapor	0.50	$3.50	$1.75	$11.75	$1.05	$14.55
Painting of Standards						
Over 18 feet	4.50	$4.00	$18.00	$0.75	$2.00	$20.75
Under 18 feet	3.00	$4.00	$12.00	$0.50	$1.75	$14.25
Maintenance of Standards						
Over 18 feet	2.00	$3.60	$7.20	$8.00	$3.30	$18.50
Under 18 feet	1.50	$3.60	$5.40	$6.25	$1.85	$13.50
Washing Luminaires*	0.20	$3.50	$0.70	$0.20	$0.75	$1.65
Damage Repairs	30.00	$4.50	$135.00	$110.00	$28.00	$273.00
Cable Repairs	10.00	$4.50	$45.00	$26.00	$9.00	$80.00
Maintenance Not Otherwise Classified		$4.50	$4.50	$2.52	$2.78	$9.80

*Luminairies are washed only during normal maintenance operations and not when a lamp is replaced due to early burn-out.

Normal maintenance of light standards has cost $8 per operation for standards over 18 feet and $6.25 per operation for standards under 18 feet. Materials cost for maintenance not otherwise classified have averaged $2.52 per operation. Todarol made similar determinations of unit costs for equipment, as shown in Table 4-2.

The unit cost data in Table 4-3 do not provide an answer to the issue of cost savings resulting from a conversion to mercury vapor lamps throughout the City of Rurbania. These data, however, do provide all the information that is required to build the analysis necessary to resolve this question. Through the interim calculations of work units per year (using Table 4-3), these data can be converted into an Annual Routine Maintenance Budget (Table 4-4).

SCENARIO #3: UNIT COST ANALYSIS

The first scenario task is to complete the inventory of maintenance and work units per year. There are, at present, 7,200 street lights in the Rurbania system. Of this number, 3,000 are mercury vapor lamps. By completing Table 4-3, you should be in a position to develop work unit data for an Annual Routine Maintenance Budget, and thereby complete the calculations for Table 3-3.

By examining those elements of the Annual Routine Maintenance Budget that would be altered by the conversion to a full mercury lamping program, it should be possible to determine the cost savings (if any) arising from the conversion of the 4,200 incandescent lights in the present system to mercury vapor lamps. This cost saving, when multiplied over the first four to five years of operations should then be compared with the cost of the City's participation in the Safe Street Act program (i.e., $120,000).

Table 4-3.--Inventory of Maintenance Operations and Work Units Per Year

	Inventory	Annual Frequency	Work Units	
			Washing	Lamping
Luminaires				
Midnight Burning	1200			
All Night Burning	2600			
Multiple Burning	400			
Mercury Vapor	3000			
Early Burn-Outs				
Total				
Standards to be Painted				
Over 18 feet	3300			
Under 18 Feet	3700			
Standards to be Maintained				
Over 18 feet	3300			
Under 18 feet	3700			
Cable System				
Number of Circuits	500			
Damage Repairs				
Total Number of Standards	7000			
Maintenance Not Otherwise Classified			200 man-hours	

Table 4-4.--Annual Routine Maintenance Budget Street Light Maintenance

Operation	Work Units	Unit Costs	Totals[*]
Washing Luminaires		$ 1.65	
Lamping Incandescents		$ 3.15	
Lamping Mercury Vapor		$14.55	
Painting Standards Over 18 feet Under 18 feet		 $20.75 $14.25	
Maintenance of Standards Over 18 feet Under 18 feet		 $18.50 $13.50	
Cable Repairs		$80.00	
Damage Repairs		$273.00	
Miscellaneous Maintenance	200	$9.80	$1,960
Total Routine Maintenance Budget			

[*] Round off all calculations to whole dollars.

INSTRUCTIONAL GUIDE #3: UNIT COST ANALYSIS

The Annual Routine Maintenance Budget for the present street light system in the City of Rurbania totals $290,476. These costs breakdown as follows:

	Work Units	Unit Cost	Total Cost
Washing Luminaires	12,000	$1.65	$19,800
Lamping Incandescents	13,800*	3.15	43,470
Lamping Mercury Vapor	1,100**	14.55	16,005
Painting Standards			
Over 18 feet	1,650	20.75	34,238
Under 18 feet	1,850	14.25	26,363
Maintenance of Standards			
Over 18 feet	330	18.50	6,105
Under 18 feet	1,110	13.50	14,985
Cable Repairs	400	80.00	32,000
Damage Repairs	350	273.00	95,550
Miscellaneous	200	9.80	1,960
Total			$290,476

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*12,000 replacements under normal maintenance plus 1,800 early burn-outs.

**1,000 replacements under normal maintenance plus 100 early burn-outs.

Of these total annual costs, the first three items, amounting to $79,275, would be impacted by the conversion to all mercury vapor lamps. The equivalent annual maintenance cost for 7,200 mercury vapor lamps would be $38,412 (i.e., (7,200 x 1.1) ÷ 3 times $14.55). Therefore, there would be an annual cost savings of $40,863, or a four year savings of $163,452, which is well in excess of the $120,000 that constitutes Rurbania's share of the cost of conversion.

It is possible to arrive at the same conclusions by only considering the lamps to be replaced, i.e., 4,200 mercury vapor lamps, replaced once every three years would yield 1,400 annual replacements plus 140 (10 percent) for early burn-outs, times $14.55 as a unit cost equals $22,407. This figure is compared to $63,270 for the present maintenance of the incandescent lights, or an annual cost savings of $40,863.

This case study/scenario illustrates how unit cost data can be used as the building blocks for an annual budget and as the basic components for a cost analysis for different operational alternatives. While not all operations of local government can be reduced to such unit cost data, a fairly significant portion of the more routine operations can be analyzed in these terms. Further, activity cost data often can be developed and can serve as the building blocks for programmatic budgets, as will be illustrated in the next case study/scenario.

ENDNOTES

1. Frederick C. Mosher, Program Budgeting: Theory and Practice (Chicago: Public Administration Service, 1954), p. 7.

2. Procedures for capital facilities planning and debt administration are the subject of a separate curriculum module in the NTDS Urban Management Curriculum Development Project.

3. For a further discussion of the critical distinction between input and output relationships in the process of budgeting, see: Anthony J. Catanese and Alan Walter Steiss, Systemic Planning: Theory and Application (Lexington, Mass.: D. C. Heath and Company, 1970), Chapter 5.

4. For a further discussion of these factors, see: International City Management Association, Municipal Finance Administration (Chicago, 1962), Chapter 6.

5. For further detail, see: Municipal Finance Administration, pp. 154-158.

6. Adopted from: Lennox L. Moak and Albert M. Hillhouse, Concepts and Practices in Local Government Finance (Chicago: Municipal Finance Officers Association, 1975), p. 329 ff.

CHAPTER 5
MAJOR COMPONENTS OF A PERFORMANCE/PROGRAM BUDGET

After over a half century of budget reform crusades, the concept of PPBS burst on the scene in the early sixties amid general enthusiasm. As with many innovations introduced by dictum, however, inadequate groundwork was laid for the establishment of a Planning-Programming-Budgeting System at the federal level and even less so in state and local governments.[1] A fairly successful technique for the evaluation of weaponry systems in the Department of Defense, PPBS had only limited immediate application in other public agencies. Soon, proponents of PPBS were faced with strong arguments concerning its "failures" even in the Defense Department. Much heat but little light arose in the ensuing debates, and the future of PPBS remains somewhat in doubt.

Such concepts as program or mission budgeting, zero-base budgeting, and related management/control techniques (strategic planning, management by objectives, productivity assessment/improvement, and performance auditing) have emerged like the proverbial phoenix out of the PPBS ashes of the sixties. Efforts will be made in the following discussion to combine and extend the fiscal planning and control elements from the management orientation of performance budgeting and the planning orientation of program budgeting to establish a foundation for a dual budgetary system that is more fully attuned to the objectives of efficiency and effectiveness. These objectives are being sought with increasing frequency in the financial management practices of local government. In addition, this dual approach adopts the elements of accountability and personnel control from more traditional budgeting approaches (line-item or objects of expenditure budgets).

PERFORMANCE/PROGRAM BUDGETING IN LOCAL GOVERNMENT

To date, performance and program budgeting techniques have had relatively limited applications outside the federal government. This situation is somewhat paradoxical, since many of these concepts are particularly adaptable to the fiscal decisions of local governments. The primary mission of local government is service. Therefore, public activities at the local level can be readily identified and often can be measured in programmatic terms. These activities frequently involve fairly routine work programs that are susceptible to the work-cost measurements and activity classifications of performance budgeting. Thus, the effectiveness and efficiency of many activities of local government could be appropriately measured and evaluated within these budgetary formats.

Resistence to the initiation of a performance/program budget approach in local government can be traced to the assumption that a high degree of technical expertise is required to undertake sound program analyses and performance evaluations. This assumption may be valid at the federal level, where overlapping and complex program missions of a multitude of agencies makes the task of program analysis extremely difficult. At the local level, however, the structuring and analysis of programs can be carried out with relative ease. Performance/program budgeting does not involve any radical departures from previously accepted budgetary methods. Rather, it embodies a re-emphasis of long accepted principles of building a budget on the basis of sound appraisals of need. Program budgeting, performance budgeting, and traditional object budgeting can be quite compatible, with each approach complementing the other.

A number of governmental entities have recently initiated program budgeting to augment an existing traditional line-item or object-of-expenditure budget. In many cases, it would appear that this augmentation is a consequence of a desire on the part of elected officials to use program budgeting or PPBS to lend greater credibility to their decisions regarding the expenditure of limited public funds. Lacking full confidence in and/or understanding of the program budgeting approach, these officials have requested parallel submissions of traditional line-item budget information. This dual submission provides a basis for determining what programs are being funded and at what levels of support, while retaining the conventional approach by which public officials have traditionally reduced budget by cutting line-item requests.

State and local governments in some cases have eliminated the line-item budget and in its place have adopted a program budget or PPB system. While some governments have been successful in these endeavors, others have faced considerable confusion and resistence to these new techniques and ultimately have abandoned program budgeting in favor of more traditional budget formats.

As a general rule, it is neither practical nor desirable to adopt over night all features of a program or performance budget. Initially, emphasis should be placed on making necessary revisions in the budget document so that an explanation and justification of expenditures is presented in terms of public service programs. Longer range goals and objectives should be identified in programmatic terms. In the early stages of conversion, such presentations may be based on the more traditional object of expenditure approach; detailed expenditure data may be aggregated in programmatic terms to provide the initial basis for the necessary reorientation to a program budget format. Within the limitations of time and data available, attention should be focused during budget preparation and review on the development of appropriate indices (performances measures and measures of effectiveness) to support all fiscal requests in terms of the agreed-upon goals and objectives. The experience of several budget cycles operating under these procedures may be required before the essential objectives of program budgeting are fully achieved.

IN SEARCH OF A COMMON DEFINITION

Although the term program budgeting is fairly constant throughout the country, applications of these concepts and methodologies differ significantly. Few program budgeting systems in operation at the state and local levels of government are identical. Many are actually performance budgets --presenting information strictly in work efficiency terms by functions, activities, or projects--although they bear the title "program budgets". Those which more closely parallel the conceptual basis of program budgeting often have been tailored to the point that they are not easily recognizable as program budgets in the pure, conceptual form. This tailoring process usually is the result of the wishes of a local governing body and should not be considered as detrimental to the basic conceptual framework of program budgeting.[2]

Five Basic Elements of Program Budgeting

The first major component of program budgeting involves an identification of major public goals and objectives in programmatic terms. As Novick observes, the purpose of program budgeting is to develop:

> . . . an awareness throughout the management system of an organization of the need for clearer identification of public goals and objectives, an active and systematic search for alternative solutions to identifiable problems, quantitative measurement of program results and costs, and an analytical framework which includes appropriate treatment of both short-term and long-term, as well as direct and indirect impacts.[3]

This component is the essence of what has been labelled strategic planning--the process of identifying public goals and objectives, determining needed changes in those objectives, and deciding on the resources to be used to attain them.[4] Strategic planning is a dynamic process involving an evaluation of policies governing the acquisition, use, and disposition of public resources and the formulation of alternative courses of action to implement these policies. This evaluation must be subjected to constant correction and refinement in establishing a desirable range within which public choices can and should be made.

A second major component of program budgeting involves the structuring and analysis of public activities in programmatic terms. In the initial formulations of program budgeting procedures, considerable attention was given to the concept of across-the-board program analysis, that is, a focus on the process of goal identification in terms of total activities without concern for the organizational prerogatives of agencies involved in program implementation. Some agencies, however, could not make the shift to such a program structure in the relatively short period mandated by many proponents of program budgeting, Indeed, the overzealous adherence to the across-the-board principle by some advocates of the system has been one of the major obstacles to effective implementation of the program budget concept. Insistence on this point by public officials has been interpreted by subordinants as a first step in governmental reorganization and has been resisted by established agencies.

More recently, this component has been set into a different time perspective--as an ideal to strive toward. In reality such an objective must be considered as long-range rather than immediate. In most cases, significant efforts must first be launched in the development of a management information and program evaluation system (MIPES) before the interdependencies of various public agencies can be examined and the goals of government programmed in a more comprehensive (and comprehensible) manner. As an interim step, public agencies should be required to identify those activities within their persent scope of operations that might more appropriately be carried out by other units of government, as well as activities within the operations of other agencies that are supportive of their mandated responsibilities.

The third component of program budgeting involves an extended time horizon and multiyear program and financial plans. An extended time horizon (five to six years beyond the current fiscal period) is designed to establish a longer range process that can circumvent the "crisis programming" characteristic of many public activities. It should serve to guide the total activities of government in a more coherent and comprehensive fashion. Multiyear program plans indicate the proposed outputs of public facilities and services according to the objectives outlined in the strategic planning stage. Such plans indicate what accomplishments can be expected for a given commitment of resources.[5] Most commonly, multiyear plans in program budgeting cover seven years: the immediate past year, the current year, the budget year, and the four succeeding years. Each year the plans are revised and updated to include one additional future year and to omit the earliest year. This format closely approximates that used in capital facilities planning for the formulation of a six-year capital improvements program. As Howard has observed:

> PPB contemplates that projections of total program costs will cover a time span more in accord with the one typically used in capital budgeting. Increasing the time horizon used in projecting operating costs would reduce the difficulties that arise when operating costs are projected for one length of time but a program's capital aspects are estimated for another.[6]

Program budgeting requires annual costs be identified in terms of those programs (clusters of agency activities), developed on a multiyear basis, that have been selected for includion in the current budget. Furthermore, these costs must be projected into the near future (multiyear financial plans) so that future cost implications of current programs can be known. Cost estimates are outlined in varying levels of detail according to the time span covered. These estimates must be matched with projections of revenue required to support the proposed programs. Only through such an examination is it possible to determine the adequacy of revenue sources in light of future demands. Once the budget is framed in programmatic terms, the total costs of a given program can be disaggregated by type of input (e.g., salaries and wages, materials and supplies, equipment, etc.). In short, multiyear program and financial plans serve as the critical link in program budgeting between goals, objectives, impacts, and outputs, on the one hand, and resource inputs on the other.

A problem associated with the formulation of multiyear plans involves the establishment of realistic constraints to prevent resulting projections from making demands upon fiscal resources that are economically and politically impractical. Such "pie-in-the-sky" proposals are precisely what began to emerge from the original PPBS efforts among federal civilian agencies in the sixties. As program and financial plans became unrealistic "wish-lists", the Bureau of the Budget changed the ground rules to include the concept of current commitments, defined by BOB Bulletin No. 68-9 as those programs for which existing legislative authorization had been received, plus specific legislative proposals put forth by the President.[7]

Program analysis--the fourth component--is the cornerstone of program budgeting. Through this systematic analysis of alternatives, programs are selected from multiyear plans. While program analysis may take several forms, in essence, it involves the reduction of complex problems into their component parts or segments so that each can be studied in greater detail, followed by a synthesis or these parts back to the whole. This analysical process must be shared by all management personnel within an organization. As R.E.W. Chrisman, Director of the Budgeting and Management Division of the State of Vermont, has observed:

> Program analysis cannot be initiated and conducted only by a budget and management staff or other centralized planning or administrative groups. Operating and functional agencies must directly participate (and frequently initiate) in-depth analyses of existing or proposed programs.

Such analyses are not only applied to information within the budget system but are also imperative for measuring the success of the implementation process.

To undertake such analyses, explicit measures of program outputs must be quantified. This task is frequently a difficult one, particularly for agency staffs more accustomed to measuring activity levels in terms of inputs rather than the outputs produced. As Krueckeberg and Silver have observed, agency personnel may offer considerable resistence to the formulation of new program output or performance measures.

> After all, it is not that difficult to spend budgeted money, and, hence, his performance, when measured in terms of "number of new hospital beds installed" or "new teachers hired," is much easier to define than performance measures such as "number of low income perosns made healthy" or "low income persons successfully trained."[8]

The analytical task in program analysis involves the use of existing resources or the generation of additional resources to create new means-ends patterns to resolve conflict over problems of choice. In general, this task entails: (1) identification of questions relevant to the inquiry; (2) operationalization of vaguely stated objectives; (3) elimination of imprecise factors; (4) ascertainment of quantifiable variables; (5) specification of assumptions; (6) selection of models and other tools of analysis; (7) specification of alternatives that meet the parameters of the selected models; and (8) selection of the "best" or "optimal" course of action or program.[9] The techniques of systems analysis, and in particular the procedures associated with cost-benefit and cost-effectiveness analysis, have formed the principal tools to accomplish this multistep task.

The final component in program budgeting involves program monitoring and updating procedures. Through such procedures, program analysis and evaluation techniques are applied once programs are implemented to determine needed modifications and improvements. The regular collection and systematic analysis of performance in a management information and program evaluation system (MIPES) can provide program managers and public officials with periodic reports by which to monitor ongoing programs and projects. These performance measures must be designed to gauge both efficiency and effectiveness of activities and operations. Such information feedback provides a basis for control and evaluation mechanisms.

Cost-efficiency and cost-effectiveness ratios, indicating relationship between program costs and actual program output, can be calculated and, if properly defined, can be used as effective tools for program control and evaluation.

The primary advantages of program budgeting should be evident from the foregoing description of its basic elements. The emphasis on specific (measurable) end-products, rather than vague statements of program objectives couched in terms of various manpower and material inputs, affords a more effective basis for evaluating agency requests relative to the goals of government. A program budget should be designed to consider public policy objectives in light of all economic costs and should stress relationships between various outputs or program benefits and the inputs in preparing budget requests, to emphasize public service products and input-to-output relationships and to give attention to a wider (and longer) range of costs and benefits.[10]

Limitations To Implementation

A principal obstacle to effective implementation of program budgeting procedures is the difficulty often encountered in attaining agreement as to the output of governmental activities--of defining appropriate measures of program effectiveness against which alternative approaches can be tested and costs evaluated. The "output" of many public activities may be difficult to define and measure, and as a consequence, secondary measures of performance (surrogates) often must be used. The problem frequently centers on the data gathering and record keeping procedures of public agencies.

Performance and effectiveness measures must be capable of identifying and measuring the actual changes or impacts experienced by a target population. At the same time, changes arising from external factors that are not attributable to the program under study must be isolated and excluded from direct program evaluation. In some public activities, this level of "causality" may require an analytic effort that is beyond the capacity of some local governments. The more "tangible" the products of a particular program or project, however, the more accessible are appropriate criteria for evaluation. Thus, the application of program budgeting techniques in local government may begin most effectively in the planning of capital facilities, for it is here that public service objectives are (or should be) most straightforward and "tangible".

It is frequently argued that the cost of generating the necessary information required for an effective program evaluation is too great in light of the consequent limited improvements in program performance. While this argument may be valid in some situations, all too often it is merely a smoke-screen to hide organized bureaucratic resistence to change or general ineptness among agency personnel. In some cases, however, defensive behavior regarding the application of program budgeting techniques is well-founded. Overzealous attempts to impose inflexible and often arbitrarily defined formats for the evaluation of complex activities, for which the analysts does not have a full understanding or appreciation, often can prove very detrimental to the program objectives of an agency. Costly data collection efforts may yield vast quantities of computer printouts, resulting in an institutionalization of the very bureaucratic inflexibilities that gave rise to the need for improved decision-making in the first place. In seeking more rational and "scientific" procedures for program analysis, safeguards must be exercised to avoid the substitution of one inflexible, ineffective structure for another.

WHAT IS A PROGRAM?

While the concept of program budgeting has been described above in general terms, one of the most critical aspects of this budgetary technique has been undefined--namely, what is a program? In governmental budgeting parlance, the terms operation, activity, function and performance often have been used in place of the work program. To achieve some specificity in meaning and a fuller understanding of the basis for program budgeting, it is necessary to regard a program as a group of interdependent, closely related services or activities which possess or contribute to a common objective or set of allied objectives. In the terminology often adopted for program budget guidelines, a program is a distinct organization of resources directed toward a specific objective of either:

(a) eliminating, containing, or preventing a public problem;

(b) creating, improving, or maintaining a condition affecting the public; or

(c) supporting or controlling other identifiable public programs.

Each program should lend itself to at least partial quantification and should bring together all costs associated with its execution.

The designation of a cluster of activities or series of operations as a program must take into account the following aspects:

(1) A program should permit the comparison of alternative methods of pursuing imperfectly determined policy objectives.

(2) Even if the objectives are clearly defined, a program should seek alternative means of achieving these ends.

(3) Programs may consist of a number of complementary components, some of which may be effective without the others and some of which are highly interdependent on the whole.

(4) A program defines a series of activities (program elements) within a larger process and usually these activities are tied or linked to other program elements.

(5) Programs may have overlapping structures, where these overlaps are used as means to meet certain common objectives.

(6) A program is concerned with a time-span of expenditures; it extends beyond the current fiscal period in its operation.

Subprograms and Program Elements

As suggested by item 4 above, programs can be further subdivided and can be combined into broader categories. In short, the budget structure can be described in terms of a hierarchical set of relationships. While the terminology used to describe this hierarchy varies in application, it is common practice to subdivide programs into subprograms and program elements, defined as follows:

> Subprogram: The broadest subdivision, as nearly as practicable, of a program; resources provided for subprograms may be interchanged for maximum accomplishment of program objectives.
>
> Element: A component of a subprogram, the purpose of which is to provide a description of different activities and facilities that contribute to the accomplishment of the subprograms.

As these definitions suggest, analysis of alternative approaches to accomplish program goals and objectives must begin at the subprogram and element levels. Program analysis, therefore, cannot focus solely on the program requests submitted by agencies to a central budget office, but must penetrate into agency level deliberations that lead to the framing of these requests.

Programs also can be grouped according to missions or functions (and subfunctions). A mission or function is the broadest subdivision of governmental efforts, stated as a general purpose. The sum of all missions or functions encompasses everything the government does to secure the safety, health, and general well-being of its people and to develop to the fullest extent possible their resources. There are no counterparts in the current federal system to the concept of missions or functions. In state and local applications of program budgeting procedures, however, this articulation of the program structure has proven most helpful in the further identification of the mission orientation of various programs that comprise the activities of government.[12]

PROGRAM PREPARATION

Programming and budgeting are different but complementary cyclical processes and should be consistent with one another. In his analysis of these functions, Mosher points out that: "Budgeting is tied in with programming in a number of ways, but the processes are fundamentally distinct; the organization and individuals concerned differ in part; and the procedures, the timing, the philosophy, and the classifications differ."[13] Good program preparation depends on the programming and budgeting systems used. In some cases, there is little difference between the two systems; in other instances, however, a significant difference does exist. When the latter situation occurs (as it often does when the techniques of budgeting and programming develop at different rates and achieve different levels of sophistication), particular care must be exercised to insure consistency in the total effort.

An Iterative Process

Organization of the decision-making process and its relation to the general framework of government plays an important role in program preparation. Basic considerations in this connection include: (1) the organizational position of decision initiating agencies (either centralized or decentralized); and (2) the time span required to complete the decision process.

Program preparation cannot be carried out effectively within a close system. Cognizance must be taken of the feedback and subsequent revisions of program definitions that must be made as part of an interative process. This process seeks ever-increasing precision in the identification of relationships between inputs (resources) and outputs (performance). The probability of change in program definitions increases as the time-span of decision increases. In short-term or tactical planning, the probability of revision and re-evaluation is considerably less than in the longer time dimensions of strategic planning. In practice, however, the time range of public programs defined under a program budget is between five and ten years.

Designing a Program Structure

Much of the literature on program budgeting carries an implicit assumption that an agency's organizational structure should be identical with its basic program classifications. It follows, then, that an agency should be reorganized if it is not in accord with the "logic" of its program structure. In application, however, the threat of major reorganization casts a shadow over more critical aspects of program budgeting.

As a consequence, this concept has been minimized in more recent program structuring efforts. For example, current directives often explicitly indicate that the program structure may or may not reflect the organizational framework of the agency. Thus, unlike the early days of PPBS, when wholesale reorganization seemed to be the order of the day, proponents of program budgeting have come to accept the fact that a relatively slow realignment of agency responsibilities, in accord with functional requirements of the program budget, is more realistic and more appropriate than a direct frontal attack.

Some initial realignment may be necessary in order to more clearly establish appropriate lines of communications, however. As a minimum, this realignment should address the need for a central agency with a mandate to carry out policy/program analysis and evaluation as a staff function of (or reporting to) the office of the chief executive.

While a central staff agency may indicate the number of structural levels desired for reporting purposes and delineate the broad functions or mission categories of government, it must be the responsibility of individual agencies to further articulate this program structure in terms of appropriate output (performance) oriented categories that cover the actual work activities of the agency. To accomplish this structural delineation, the agency must seek answers to the following questions:

(1) Why? -- statements of agency goals

(2) What? and When? -- statements of agency (or program) objectives in terms of priorities.

(3) How?-- identification of strategies or action to be undertaken to achieve identified objectives.

It also is necessary for an agency to identify the measures of output (service units, clients, or products) that will be used to determine performance effectiveness throughout the operation of the program. Responses to these questions assist in the definition of the "program tree" or hierarchy of programmatic activities that will be pursued in the accomplishment of public goals and objectives. While actually an interative process of continuous redefinition and clarification, for convenience this hierarchical ordering problem can be discussed as if it involved separate, sequential steps.

Qualitative Goal Statement

Statements of agency goals should be understandable, positive, and concise, and must be consistent with appropriate statutes and policies. Goals should be related directly to the broader components (missions or functions) within the overall budget structure. Clear responsibility and accountability should be assigned for program development and maintenance.

The formulation of precise but non-quantitative statements of agency goals as the first step in designing the program structure is not an easy task. A common tendency is to describe what the agency does rather than to address the question of why these activities are appropriate within the mandate of the agency. As Taylor has observed,[14] it often is helpful to pose the question: "What are we really trying to accomplish, and for whom?" Thus, the goal of a state employment assistance agency is not "To interview, test, counsel, and place unemployed persons in jobs." This statement focuses on process, rather than on mission. Rather, one of the goals of an employment assistance agency might be stated: "Assist the unemployed in securing satisfactory jobs appropriate to their abilities so as to contribute to an increased standard of living for individuals and families within the state." Subgoals or objectives might be concerned with accomplishing the principal goal for specific target groups, such as the disadvantaged, handicapped, residents of urban ghettos, and the rural unemployed.

Agency/Program Objectives

In identifying program objectives, an effort should be made to specify key results to be accomplished within a specific target period. Program objectives should be quantifiable, and while they should be realistic and attainable, they should also present a challenge to improve conditions consistent with existing governmental policies, practices, and procedures and directly related to program goals. A program objective must also be consistent with the resources available (or anticipated) and should assign singular responsibility and accountability even in joint efforts. The setting of objectives is perhaps the most critical part of the planning and budgeting process. Program objectives become the building blocks of an agency's work program.

Program objectives should specify the what and the when of anticipated agency activities. There is a tendency, however, to focus on the how. Thus, an appropriate program objective of a Division of Forestry might be: "To reduce current timber losses resulting from forest fires by twenty-five percent during the coming biennium." A statement: "To establish and man twenty new fire towers in high incidence fire areas during the biennium" tells how the program objective might be accomplished and should be reserved for the next level of detailing.

Following the establishment of a structure of program goals and objectives, the next step in the iterative process is to group agency activities according to the objectives to which they contribute or relate. Each separate activity cluster thus identified in the program structure is usually known as a program element. It is at this level that the resource inputs of line-item budgets often re-enter the scene. To be effective, however, the program structure must be more than merely a re-grouping in pseudo-programmatic terms of traditional objects of expenditure. Such approaches, masquerading as program budgeting, only tend to perpetuate the procedures and activities of the past.

Identification of Strategies: How Statements

To avoid this pitfall, agencies should be required to describe how and where specific resources (personnel, equipment, materials, capital expenditures, etc.) will be used in accomplishing program objectives. Such justifications at the program element level are often designated as strategy statements. A strategy statement should specify the means for achieving a single key result based on the resources (fiscal and personnel) available or anticipated and within the authority and responsibility of a program objective and must be consistent with statutes and policies.

These statements, in turn, should be related performance measures that identify the products, service units, or clients associated with the activities of the agency in carrying out the operation of a program. Performance measures should provide mechanisms for determining the success (or lack thereof) of an objective. While such measures may be equated to inputs, efforts must be made to go beyond the more traditional workload measures which tend to measure efficiency rather than effectiveness. Measures such as "number of man-days spent . . .," "number of cases per worker," and "number of requests received . . ." may be appropriate in measuring agency efficiency but do not provide a measurable base for assessing the effectiveness of programs or activities in relation to their costs.

These strategy statements also can be used to determine the adequacy of current or proposed funding levels by asking such questions as: What combination of inputs can most appropriately be applied to achieve the level of outputs sought? How much more resources will be needed to attain this level? If the limitations of available resources prohibit the attainment of this tentative level, what estimated level could be achieved within the budget constraints? It is in this context that the input orientation of traditional budgeting procedures is brought into equilibrium with the output orientation of performance/program budgeting. Without a systematic effort on the part of agencies to define appropriate measures of performance and effectiveness, however, there is no "base line" against which to test the notion of adequacy, and as a consequence, the traditional "least cost" compromise is likely to prevail.

It must again be emphasized that the procedural steps in the design of a program structure are not performed sequentially but more often occur through a series of iterations. In articulating program goals and objectives, for example, further clarification and amplification of the descriptive statements for programs and subprograms may be achieved. This application, in turn, may assist in determining which activities (elements) should be placed within each subprogram. Sometimes it will not be possible, however, to formulate precise statements of goals and objectives (and hence to delineate programs and subprograms) until the activity schedule of the agency has been examined in some detail. The establishment of such schedules, in turn, may require careful examination of alternative strategies and associated measures of performance.

In designing a program structure, it is often useful to ask not only the question: "What are we really trying to accomplish, and for whom?", but also: "What are we currenly doing and for whom?" Thus, the program structure must be viewed from the top down in terms of goals and objectives and from the bottom up in terms of the agency activities that are designed to carry out these goals and objectives.[15]

Levels of Expenditure/Performance

Traditional budgetary procedures frequently consider annual or biennial appropriation requests only in terms of increments of expenditure over-and-above the previous year's level. These practices have resulted in a number of abuses in terms of the principles of effectiveness and efficiency.

One of the basic objectives of zero-base budgeting, therefore, is to circumvent the unchallenged continuance of program activities (elements) that cannot be justified in terms of their contribution to a total program structure. The notion that budgetary requests should be justified and reviewed in the context of total proposed program expenditures, rather than merely the changes from previous appropriation levels, was one of the more controversial features of PPBS, and one that contributed significantly to its premature demise at the federal level.

The concept of zero-base budgeting, taken in its more literal interpretations, has proven to be too cumbersome and unwieldy to be operational in most public budgeting systems. Therefore, while it is important to recognize the fundamental objectives of zero-base budgeting, it is necessary to explore alternative approaches more amenable to contemporary budgetary practices.

Building on earlier models by Verne B. Lewis and Herbert A. Simon, Merewitz and Sosnick have introduced a set of procedures that supports the objectives of zero-base budgeting, but which are more manageable in terms of the time and resources required. Their approach is to formulate budget estimates and justifications for three levels of expenditures: (1) the same-dollar amount as the prior appropriation, (2) the same-performance amount, and (3) the recommended amount. The same-dollar amount is the sum last appropriated for the agency's programs, whereas the same-performance amount is that sum the agency would require in order to produce the same quality and quantity of outputs (services) as the last appropriation achieved. In effect, these two estimates represent a fixed-budget approach--what level of output can be provided for the same funded level of support as in the previous year--and a fixed-benefits approach--how much will it cost to provide the same level of benefits as was achieved in the immediate past operations of the agency. The recommended amount represents that sum the agency believes would be most appropriate to carry out its responsibilities and would require justification for any extensions of funding beyond the same-performance level of appropriation. Each of these budget estimates should be based on criteria of performance and effectiveness. This approach, in informational terms, represents a significant departure from traditional budget justification procedures.

A variation on this approach has been adopted in the program budgeting procedures of a number of state and local governments. Under these procedures, each program request must be justified according to three levels of effort: (1) the cost of continuing the present level of activities; (2) the cost involved in processing any changes in workload; and (3) the cost related to the adoption of new or changed levels of service. This approach operates essentially on a fixed-benefits principle in that it does not require agencies to identify what could be accomplished (or what would have to be foregone) with the same dollar level of appropriations.

The estimate of expenditures required to continue the present level of activities, without change in quality, scope, or workload, should include: (1) adjustments for cost inflation encountered in the previous fiscal period and anticipated in the coming fiscal period; (2) the cost impacts of salary scale adjustments and merit increases; (3) changes in federal or state matching formulas for specific programs anticipated and approved by previous legislative action. Estimated work loads used in determining appropriations for the immediately preceding fiscal year should be identified. If a work load or other activity reduction is anticipated, this reduction would be reflected in the program request under this level of justification.

The second estimate, focusing on changed work load, should reflect the costs resulting from work unit additions in the present level of activities without any changes in the scope or quality of services. In effect, this estimate examines the consequences of providing the same level of service to a larger clientele. Work unit additions required by existing policy or legislative mandates or additional mandated responsibilities (beyond budgeted levels) occurring in the past fiscal period should also be identified in this second estimate.

The third estimate should include costs for those activities which (1) have not previously been operated by the jurisdiction; (2) were previously funded (directly or indirectly) by intergovernmental transfers for which direct appropriations by the jurisdiction are newly requested; (3) represent a proposed change in the scope or quality of services provided; or (4) are required by legislation since the last appropriation. In short, this third estimate accounts for shifts in program funding responsibilities; as well as program/service expansions and enrichments.

A DUAL BUDGETARY SYSTEM

Performance/program budgeting is oriented toward a strengthening of the role of strategic planning in the budgetary process. The primary objective of performance/program budgeting is to secure more rational bases for decision-making as related to the allocation of scarce fiscal resources. This greater rationality is accomplished by providing the following elements: (1) increased efficiency through an analysis of data on the costs and benefits of proposed public objectives, and (2) increased effectiveness through measurements of output (performance) to facilitate a continual review of public activities. As a mechanism for policy analysis, performance/program budgeting departs from more basic models of efficiency in which objectives are fixed and quantities of inputs and outputs are adjusted to secure an optimal relationship. In performance/program budgeting, policy and program objectives may be considered as variables, with analysis aimed at creating new objectives were appropriate.

Performance/program budgeting focuses on aggregates of expenditures (i.e., broad program classifications that may cut across established lines of responsibility). The emphasis is on comprehensiveness and on the grouping of data into categories that facilitate comparisons among alternative mixes of public expenditures. Detailed object-of-expenditure classifications, as found in traditional line-item budgets, are brought into play as they may contribute to the analysis of the total system. These more detailed classifications offer two distinct advantages not possessed by other budget systems: (1) accountability--a pattern of accounts that can be controlled and audited; and (2) information for personnel management--personnel requirements are closely linked with other budgetary requirements, and the control of positions can be used to control the budget. These administrative features of a line-item budget (used for documentation and accounting of both monies and personnel) are retained in the performance/program budget model, thus providing a "dual system" for policy formulation and administration.

This dual or complementary system of budgeting is designed to offer different information formats, reflecting the range of decisions that must be made at various points in the budgetary process. The basic premise is that a program budget is intended primarily for the purposes of policy/program analysis, whereas the traditional line-item budget serves the purposes of administrative analysis and control. The performance budget places emphasis on efficiency in output terms, but also offers mechanisms of control through such cost accounting devices as workload measures and unit cost data. While these functions are overlapping, such that no clear-cut distinctions can be made, the informational needs of each can be facilitated by the characteristic formats of this dual approach.

The case study and scenario that follow illustrate the technique of a budget crosswalk--procedures for translating information from a traditional budget format to a programmatic approach, and vice versa. The concept of a budget crosswalk is very supportive of a dual budgetary system. Many of the characteristics of performance/program budgeting also are illustrated by these exercises.

CASE STUDY #4: PERFORMANCE/PROGRAM BUDGET CROSSWALK

The City of Rurbania has experienced considerable growth during the past several years. As a consequence, the city has been faced with rapidly expanding demands for new and improved public services and facilities for which its revenue base has not kept pace. Rising costs for government operations resulting from the impact of inflation, coupled with increased personnel costs, have brought Rurbania to a critical fiscal position. While the City Council has been able to maintain a balanced budget and has not been forced to resort to deficit financing insofar as operating expenditures are concerned, there is a general reluctance to increase local taxes or to adjust fee schedules adequately to compensate for the rising costs of government. Instead, greater reliance has been placed on intertovernmental transfers (i.e., state and federal grant programs) to meet the growing demands for expanded public services.

Prior to the initiation of the budget cycle for the current fiscal year, Rurbania received an LEAA grant to experiment with the formulation of a program budget format, with particular reference to its Police Department. Inspector Claude Cloussieux, fiscal officer for the Police Department, and Eric Snerdley, a budget analyst, were given principal responsibility for this LEAA funded study.

Cloussieux and Snerdley recognized that the traditional line-item budget offers several distinct advantages that would be useful to retain in whatever format was developed for program budgeting. Appropriations are made according to organizational units, with specific amounts designated for each object of expenditure. Funds cannot be obligated except for objects specified, and each expenditure is subject to a separate pattern of documentation. The status of existing personnel and proposed changes are clearly set forth in a line-item budget, and personnel requirements can be closely linked with other budgetary requirements. The control of positions, therefore, can be used as the lever to manage the whole of the budget.

The major weakness of a line-item budget, however, stems from this same level of detail. Traditional informational categories make overall comparative analysis difficult because the line-item budget is based on "particular" (i.e., specific items of expense) rather than on "wholes". A line-item budget focuses on the inputs (resources used) rather than on the outputs (what is accomplished).

Program budgeting attempts to remedy this deficiency by organizing budget information according to the objectives of government. In other words, the structure of a program budget emphasizes the ends to be achieved and facilitates the translation of these ends into costs required for their accomplishment. The first step taken by Cloussieux and Snerdly, therefore, was to develop a comprehensive program structure within which the various activities of city government could be organized and analyzed. The ten programs and associated subprograms that they identified are listed on the following page.

PROGRAM STRUCTURE: CITY OF RURBANIA -- Adopted from LEAA Study on Program Budgeting

I. Public Safety--Security of Persons and Property

- a. Law Enforcement
- b. Traffic Safety
- c. Fire Safety
- d. Maintenance of Public Order
- e. Presention & Control of Other Hazards
- f. Administration & Support

II. Housing and Community Development

- a. Housing Standards & Code Enforcement
- b. Community Improvement
- c. Administration & Support

III. Transportation

- a. Traffic Control & Accessibility
- b. Street Development & Maintenance
- c. Mass Transportation
- d. Administration & Support

IV. Environmental Enhancement and Protection

- a. Environmental Health
- b. Water Services
- c. Sewer Services
- d. Sabitation Services
- e. Environmental Code Enforcement
- f. Administration & Support

V. Human Resources

- a. Conservation of Health
- b. Financial Assistance and Services
- c. Vocational Rehabilitation
- d. Ambulance & Rescue Squad Services
- e. Public Health Services

VI. Education

- a. Public Schools
- b. Adult & Vocational Education
- c. Community College Services
- d. Higher Education Opportunities

VII. Recreation and Culture

- a. Recreation and Parks
- b. Youth Opportunity Services
- c. Cultural Enrichment (inc. Libraries)
- d. Administration & Support

VIII. Economic Development

- a. Industrial Development & Promotion
- b. Job Opportunity Development
- c. Consumer Protection & Regulation
- d. Administration & Support

IX. Finance and Revenue

- a. Financial Operations (Purchasing)
- b. Assessment and Tax Collections
- c. Internal Audit and Records
- d. Recorder of Deeds
- e. Administration & Support

X. Executive Direction and General Support

- a. City Council
- b. Executive Direction and Management
- c. City Planning
- d. Budget and Control
- e. Human Relations & Equal Opportunities
- f. Employee Development & Service Benefits
- g. Voter Registration & Elections
- h. Community Relations
- i. General Service Administrative Support

While Cloussieux and Snerdley recognized that these programs and sub-programs would require further modification as experience was gained with program budgeting procedures, they suggested that these categories be utilized to provide an initial framework.

Cloussieux and Snerdley next analyzed budget information for the Police Department as it would appear in a traditional line-item budget. The example shown on the following three pages is for the Investigations Division (while Cloussieux and Snerdley analyzed the total operations of the Police Department, the data for the Investigations Division will be used to illustrate each step in their analysis).

The budget request of the Investigation Division begins with a series of "comments" designed to explain and justify the increases requested for the next fiscal year over the current budget. Data are provided for the last fiscal year, as well as for the current budget and the next fiscal year, in accordance with typical account classifications or objects of expenditure. It should be noted that personnel services (salaries and wages) account for approximately 96 percent of the total budget allocation of the Investigations Division. This relatively high percentage is due largely to the practice of recording a number of maintenance and operations costs (e.g., contractual services such as utilities and communications, materials and supplies, and equipment) against a general administrative account rather than including these costs in the Division's budget. As a consequence, it is most difficult on the basis of this line-item format to assess the cost-efficiency or cost-effectiveness of activities in the Division, since not all of the cost factors are specifically identified.

The second entry illustrates the work program and the schedule of personnel for the Investigations Division. While the work program indicates the general investigative and support responsibilities of each of the sections within the Division, goals and objectives appropriate to the agency's operations are expressed in only the most general terms.

As the next step in their analysis, Cloussieux and Snerdley organized cost allocations in terms of work performance data (Table 5-3). Each division of the Police Department currently is required to submit annual "case load" data to the Law Enforcement Assistance Administration. These data provided Cloussieux and Snerdley with the basic units of analysis, which they then translated into the man-hours required to carry out these responsibilities to determine appropriate measures of work performance. Actual data for last fiscal year were translated into costs and were then extended to activity units, man-hours, and costs for the current fiscal years. In preparing these estimates, Cloussieux and Snerdley were assisted by several key members of the Department staff. The budget requests presented in line-item format for the next fiscal year were then translated into these same work performance measures.

As shown in Table 5-3, increases are projected in the number of units for nearly all activities (the exception being lectures by members of the Vice Squad--this activity is being shifted over to the Community Relations Section). In most cases, however, the units of activity handled by each of the sections are estimated to increase at a faster rate than the number of

TABLE 5-1

FUND:	DEPARTMENT:	DIVISION:
General	Police	Investigations

BUDGET COMMENTS

As a result of the reorganization of the police Department, the staff of this division has been increased by two persons. This budget is up by 11.61%, or $31,649, over the previous budget period.

Personal Services show an increase of $31,857. This increase is the result of the two new employees ($18,675), a five percent salary increase for all city employees ($12,185), and a $997 increase in retirement benefits and the education fund.

Increased emphasis is placed on Vice Squad purchase of information regarding drugs. This increase is shown in Account 270. Also, all miscellaneous travel for the department has been consolidated into the budget in Account 230. Overall, the Contractual Services accounts increased by $524.

The Commodities accounts show an $80 increase; this will be used to purchase more research and reference materials for use in the Police Laboratory.

There was a $812 reduction in the Capital Outlay accounts. The $250 approved for the next fiscal year will be applied toward the purchase of photography drying equipment in the Police Lab.

Account Classification	Last Fiscal Year	Current Budget	Next Fiscal Year
Personnel Services			
110 Salaries and Wages	$245,741	$260,458	$292,315
120 Employee Claims	--	--	--
Subtotal: Personnel Services	$245,741	$260,458	$292,315
Contractual Services			
210 Utilities	--	--	--
220 Communications	--	--	--
230 Transportation	307	624	693
240 Advertising	148	277	215
250 Insurance	--	--	--
260 Dues & Subscriptions	134	114	160
270 Professional Services	1,454	2,216	2,548
280 Maint. of Bldgs. & Improve.	--	--	--
290 Maint. of Equipment	135	235	235
295 Other Contract Services	--	--	139
Subtotal: Contractual Services	$ 2,178	$ 3,466	$ 3,990

TABLE 5-1 (continued)

Account Classification	Last Fiscal Year	Current Budget	Next Fiscal Year
Commodities			
310 Office Supplies	$ 1,603	$ 1,784	$ 1,844
320 Clothing & Linen	2,180	2,341	2,408
330 Food, Drugs, Chemicals	2,632	3,017	3,123
340 Operational Supplies	--	--	--
350 Repair Parts	46	80	80
360 Operating Supplies-Equip.	103	168	140
370 Repair Parts-Equip.	--	227	110
380 Operating Supplies-Const.	--	--	--
390 Minor Apparatus & Tools	14	39	25
395 Other Commodities	--	--	--
Subtotal: Commodities	$ 6,578	$ 7,650	$ 7,730
Capital Outlay			
410 Land	--	--	--
420 Buildings	--	--	--
430 Other Improvements	--	--	--
440 Office Equipment	375	176	--
450 Vehicular Equipment	--	--	--
460 Operating Equipment	538	886	250
470 Other Capital Outlay	--	--	--
Subtotal: Capital Outlay	$ 913	$ 1,062	$ 250
TOTAL	$255,410	$272,636	$304,285

TABLE 5-2

FUND:	DEPARTMENT:	DIVISION:
General	Police	Investigations

WORK PROGRAM

It is the responsibility of the Investigations Division to follow up on criminal cases which were initially handled by patrol officers. The Investigations Division is separated into units which handle specific types of crime or clientele. The Detective Section investigates the majority of reported crimes; the Vice Squad investigates crimes involving moral turpitude, liquor, and gambling; the Juvenile Section investigates all crimes involving children and the mentally ill; and the Laboratory Section provides scientific assistance to all types of investigations. These sections investigate cases, arrest violators, and prepare prosecution assistance to the courts.

Position Title	Employees		Monthly Salary Range	Current Budget	Next Fiscal Year
	Current	Request			
Lieutenant	1	1	877-986	$ 10,950	$ 11,500
Lab. Supervis.	1	1	800-900	10,000	10,500
Sargeant	2	2	781-877	19,240	20,200
Inspector	3	4	618-829	26,385	36,940
Detective	15	16	600-800	134,850	151,040
Property Clerk	1	1	550-735	6,980	7,330
Photographer	1	1	500-700	7,380	7,750
Photo. Tech.	1	1	390-520	5,715	6,000
Secretary	1	1	440-585	5,980	6,280
Clerk-Steno	3	3	365-490	16,000	16,800
Subtotal	29	31		$243,480	$274,340
Add:					
Retirement				$ 8,293	$ 8,651
Education				8,685	9,324
TOTAL				$260,458	$292,315

man-hours required to carry out these activities. For example, the number of cases handled by detectives is projected to increase by 10.3 percent between the past fiscal year and the next fiscal year, while the number of man-hours required is projected to increase by only 2.3 percent. Similarly, the number of cases handled by the Juvenile Section is projected to increase by 41 percent over three fiscal years, while the man-hour increase in this period is only 27.8 percent. As a consequence of increased cost for personnel services, however, a portion of the "economies" achieved by increased work loads will be wiped out. For example, the cost of activities associated with the Detectives Section are projected to increase by 6 percent over the three fiscal years, while the increase in costs in the Juvenile Section in this period is projected at 36.2 percent.

While these work performance data provide some insight into the general efficiency of operations within the agency under analysis, the full impact cannot be determined without further information relating both direct and indirect costs. Comparisons among fiscal years require that these data be brought to some appropriate unit-cost basis.

The next step in their analysis involved Cloussieux and Snerdley in an exercise to re-align the various activities of the Police Department in terms of program elements and, in turn, to group these program elements according to sub-programs and programs. This exercise resulted in the formulation of a "program tree" which illustrates the hierarchical relationships among activities (i.e., specific resources that contribute to each objective of a public program), program elements (the basic building blocks of a program structure), and sub-programs (divisions established within each program on the basis of narrower objectives which contribute directly to the broad objective of the program as a whole). In developing this program structure, Cloussieux and Snerdley attempted to determine appropriate output-oriented (performance-oriented) categories that cover the work of the Police Department. The resulting program tree is illustrated on page 89 .

To accomplish this structural delineation, it was necessary for Cloussieux and Snerdley to seek answers to the following basic questions:

(1) Why? (statements of agency goals)
(2) What and When? (statements of agency objectives in terms of priorities)
(3) How? (identification of strategies or actions to be undertaken to achieve identified objectives)

It was necessary for Cloussieux and Snerdley to identify the measures of output (products, service units, or clients) that can be used to determine performance effectiveness throughout the operation of the program. Responses to these questions assisted in the definition of the program tree associated with and pursued in the accomplishment of the programs of the Police Department.

The programmatic hierarchy developed by Cloussieux and Snerdley for Public Safety is illustrated, in part, by the following tables. The program goal defined by Cloussieux and Snerdley is: "To reduce the amount and effect of external harm to persons and property; and to maintain an atmosphere of personal security." The six sub-programs are arrayed ("unassignable" represents the sub-program of "administration and support") with estimated dollar

VI.6.88

TABLE 5-3

FUND: General DEPARTMENT: Police DIVISION: Investigations

ACTIVITY DESCRIPTION	Last Fiscal Year			Current Budget			Next Fiscal Year		
	No. Units	Man Hours	Cost	No. Units	Man Hours	Cost	No. Units	Man Hours	Cost
DETECTIVES									
Cases	5,782	28,808	$133,000	5,898	29,000	$134,457	6,375	29,460	$141,045
VICE SQUAD									
Licenses Processed	210	1,198	$ 5,762	208	1,132	$ 5,473	220	1,625	$ 8,410
Arrests	308	6,185	29,772	340	6,822	$ 33,061	405	8,125	42,055
Lectures	10	107	516	28	331	1,606	6	80	410
Subtotals		7,490	$ 36,050		8,285	$ 40,140		9,830	$ 50,875
JUVENILE									
Cases	3,273	8,643	$ 41,508	3,764	9,470	$ 46,178	4,616	11,045	$ 56,550
LAB SERVICES									
Examinations	9,897	6,014	$ 24,658	10,392	5,945	$ 28,180	11,120	5,895	$ 28,416
Investigations	2,605	561	2,301	2,735	569	2,697	2,924	574	2,768
Evidence Proc.	8,581	1,848	7,578	9,009	1,875	8,885	9,640	1,895	9,127
Impounded Autos	865	186	764	908	189	895	970	190	920
Misc. Property	865	186	764	910	190	895	972	191	920
Photography	27,917	2,127	8,690	28,576	2,156	10,191	30,000	2,177	10,487
Firearm Regis.	82	25	97	86	30	118	97	35	120
Audio-Video	--	--	--	--	--	--	--	708	3,057
Subtotals		10,947	$ 44,852		10,954	$ 51,861		11,665	$ 55,815
TOTALS		55,888	$255,410		57,709	$272,636		62,000	$304,285

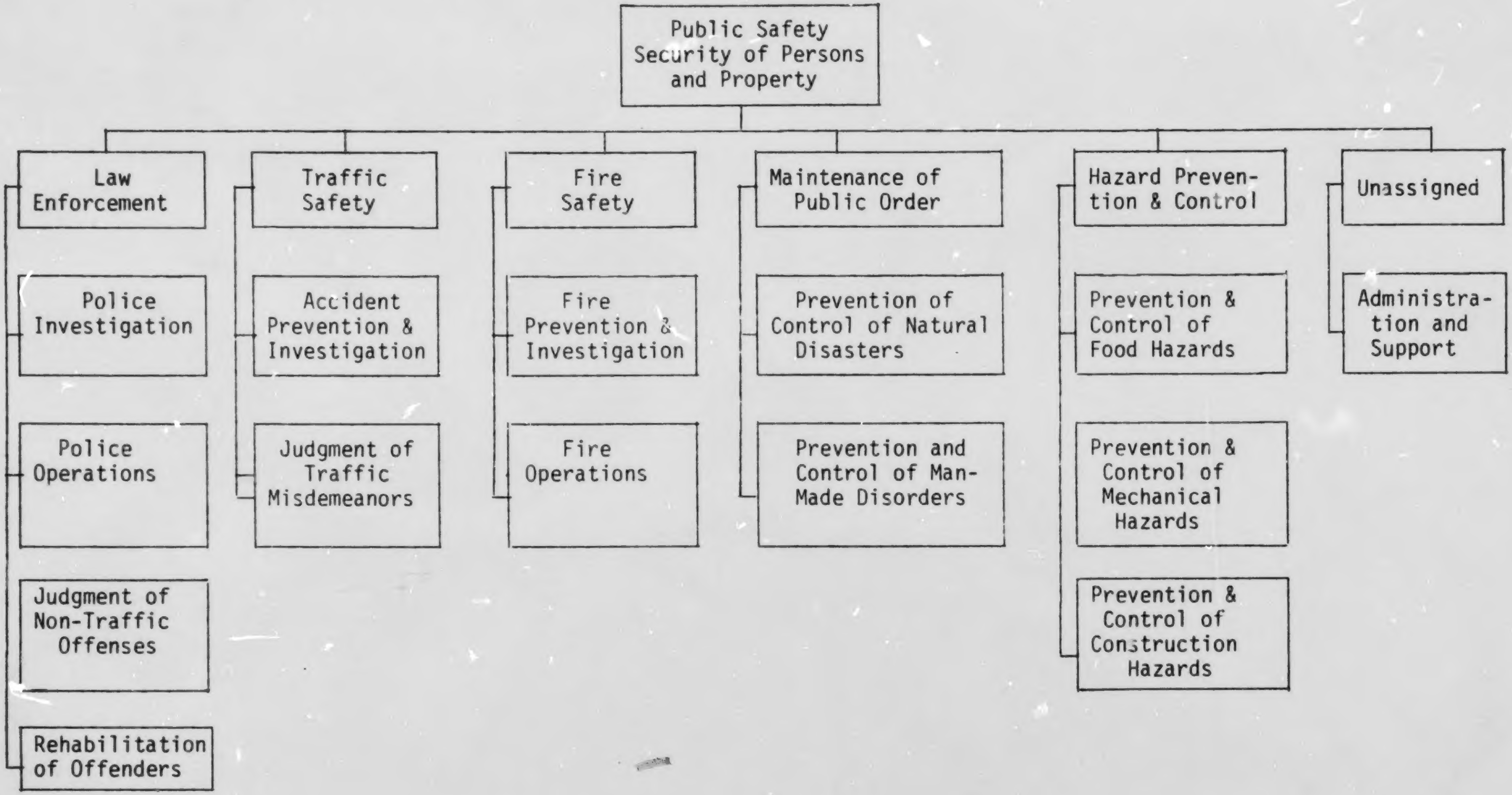
Public Safety Security of Persons and Property
Law Enforcement
Police Investigation
Police Operations
Judgment of Non-Traffic Offenses
Rehabilitation of Offenders
Traffic Safety
Accident Prevention & Investigation
Judgment of Traffic Misdemeanors
Fire Safety
Fire Prevention & Investigation
Fire Operations
Maintenance of Public Order
Prevention of Control of Natural Disasters
Prevention and Control of Man-Made Disorders
Hazard Prevention & Control
Prevention & Control of Food Hazards
Prevention & Control of Mechanical Hazards
Prevention & Control of Construction Hazards
Unassigned
Administration and Support

FIGURE 5-1. City of Rurbania Program Tree for Public Safety

cost shown for the next fiscal year in Table 5-4. In this initial phase of analysis, Cloussieux and Snerdley decided to assign all administrative and support costs to the other sub-programs. It frequently is not possible to make such complete cost assignments, and therefore, the "all other" or "unassignable" sub-program category is necessary.

In stating the objective for the sub-program of law enforcement (Table 5-5), Cloussieux and Snerdley elected not to provide a quantified statement, leaving this level of specificity to the output objectives of individual program elements. Thus, the sub-program objective is: "To reduce the amount and effect of crime; and in general, to maintain an atmosphere of security from unlawful behavior."

As shown in Table 5-5, the sub-program of law enforcement is organized around four program elements. One of these elements deals with police investigations which closely parallels the activities and responsibilities of the Investigations Division. However, a comparison of the budget request for next fiscal year under the program budget format ($353,594) with that of the Division under the line-item format ($304,285) would suggest that some additional activities (cost factors) are included in the program element.

Table 5-6 illustrates the "crosswalk" that was performed on the activities associated with the Investigations Division to arrive at the cost data for the program element. Each of the activities were subdivided into the components which form the building blocks for the program element--misdemeanors, felonies, and admistration and support. Several activities have been transferred to other elements on the basis that they are not totally compatible with the major objectives of the program element. At the same time, additional administrative costs have been added to the program element to more accurately reflect the full cost of operations.

The results of the crosswalk are summarized in Table 5-7. The program element objectives are: (1) To reduce the percent of increase in the number of misdemeanors reported by three percent; (2) To reduce the absolute number of felonies reported by two percent per year; and (3) To provide necessary training for all sworn personnel in proper law enforcement methods. It should be noted that all training costs have been included in the subprogram on police operations, although the activity has been included under this program element to correspond with the element objective. It is also of interest to note that the program element objective associated with misdemeanors is expressed in percentage terms, while the objective associated with felonies is expressed in absolute terms. Both approaches are acceptable.

Data presented in Tables 5-4, 5-5, and 5-7 illustrate the goal-oriented budget format in accordance with the textbook definition of program budgeting. Public resources are aggregated and allocated according to agreed-upon goals and objectives. Each level of aggregation in the program structure is allocated a certain level of funding, and these amounts can be aggregated upward or disaggregated downward. Thus, the program structure forms a pyramid or programmatic hierarchy.

TABLE 5-4.--City of Rurbania Summary of Expenditures

PROGRAM:	SUB-PROGRAM	PROGRAM ELEMENT:
Public Safety	All	

SUB-PROGRAMS	Last Fiscal Year	Current Budget	Next Fiscal Year
Law Enforcement	$1,077,385	$1,131,725	$1,246,481
Traffic Safety	404,300	444,735	493,656
Fire Safety	943,460	1,047,240	1,193,020
Maintenance of Public Order	128,635	141,500	157,067
Prevention and Control of Other Hazards	166,220	226,915	231,025
Unassignable	-0-	-0-	-0-
TOTAL	$2,720,000	$2,992,115	$3,321,249

PROGRAM OBJECTIVE

To reduce the amount and effect of external harm to persons and property; and to maintain an atmosphere of personal security.

Table 5-5

CITY OF RURBANIA
SUMMARY OF EXPENDITURES

PROGRAM:	SUB-PROGRAM:	PROGRAM ELEMENT:
Public Safety	Law Enforcement	All

Program Elements	Last Fiscal Year	Current Budget	Next Fiscal Year
Police Operations	$ 659,193	$ 692,430	$ 762,642
Police Investigations	305,626	321,041	353,594
Judgment of Non-Traffic Offenses and Assignment of Penalties	43,482	45,675	50,306
Rehabilitation of Offenders	69,084	72,579	79,939
TOTAL	$1,077,385	$1,131,725	$1,246,481

SUB-PROGRAM OBJECTIVE

To reduce the amount and effect of crime; and in general to maintain an atmosphere of security from unlawful behavior.

TABLE 5-6

CITY OF RURBANIA
PROGRAM CROSSWALK

PROGRAM:	SUB-PROGRAM:	PROGRAM ELEMENT:
Public Safety	Law Enforcement	Police Investigations

	Retained in Program Element		Transferred to Other Elements	
ACTIVITY DESCRIPTION	Man Hours	Cost	Man Hours	Cost
DETECTIVES				
Misdemeanors	10,310	$ 49,366		
Felonies	19,150	91,679		
VICE SQUAD				
Licenses			1,625	$ 8,410
Arrests			555	2,872
Misdemeanors	2,650	13,714		
Felonies	4,920	25,469		
Lectures			80	410
JUVENILE				
Misdemeanors	3,480	17,820	387	1,980
Felonies	6,460	33,075	718	3,675
LAB SERVICES				
Examinations	5,895	28,416		
Investigations	574	2,768		
Evidence Proc.	1,895	9,127		
Impounded Autos			190	920
Misc. Property			191	920
Photography	2,177	10,487		
Firearm Regis.			35	120
Audio-Video	708	3,057		
TOTALS	58,219	$284,978	3,781	$19,307
OTHER COSTS				
Administration	13,781	$ 68,616		
GRAND TOTAL	72,000	$353,594		

TABLE 5-7

CITY OF RURBANIA
SUMMARY OF EXPENDITURES

PROGRAM:	SUB-PROGRAM:	PROGRAM ELEMENT:
Public Safety	Law Enforcement	Police Investigations

Activities	Last Fiscal Year	Current Budget	Next Fiscal Year
Misdemeanors	$ 69,316	$ 72,367	$ 80,900
Felonies	128,729	134,397	150,223
(Training)*	-0-	-0-	-0-
Administration & Support	107,581	114,277	122,471
TOTAL	$305,626	$321,041	$353,594

*All training costs have been included in the sub-program Police Operations.

PROGRAM ELEMENT OBJECTIVE

To reduce the percent of increase in the number of misdemeanors reported by three percent.

To reduce the absolute number of felonies reported by two percent per year.

To provide necessary training for all sworn personnel in proper law enforcement methods.

In the final phase of their analysis, Cloussieux and Snerdley developed program information consisting of work data, measures of efficiency and effectiveness, and activity costs. These data can be presented in terms of the existing organizational data can be presented in terms of the existing organizational structure or in programmatic terms (as is the case in Tables 5-8, 5-9, and 5-10). The level of disaggregation of these data will depend upon the analytical purposes envisioned for the information.

Measures of efficiency, such as the ratio between total activity costs and full-time equivalent personnel assigned to a given activity, provide a basis for comparison among several fiscal periods as to the efficient use of resources. While the cost/FTE ratio for a given fiscal year is likely to be higher than that of the previous fiscal year (due to the impact of inflation and salary adjustments), if the percentage increase is less than that which would have been the consequences of inflation, then it may be said that the resources assigned to this activity are being used more efficiently. For example, the cost of labor associated with the investigation of felonies is projected to increase by 6.27 percent current fiscal year and the next fiscal year, while total costs is projected to increase by 11.78 percent during this period. The cost per FTE, however, is estimated to increase by only 4.38 percent.

Concluding Remarks

A primary goal of program budgeting is to secure a more rational basis for decision-making by providing: (1) data on the costs and benefits of alternative approaches to the attainment of proposed public objectives, and (2) measurements of output (effectiveness or performance) to facilitate a continual review of programs and sub-programs designed to attain chosen objectives. The analysis pursued by Inspector Cloussieux and Mr. Snerdley addresses the second of these purposes and established a foundation for the first.

Program budgeting focuses on aggregates of expenditures, with detailed itemization of expenditure categories brought into play only as they may contribute to the analysis of the total system or in terms of their potential impact on marginal trade-offs among competing proposals. In program budgeting, the emphasis is on comprehensiveness and on the grouping of data into categories that facilitate comparisons among alternative mixes of public expenditures. The program budget should be viewed as a statement of public policy.

The features of accountability and personnel management which are distinct characteristics of the line-item budget can be retained, in part by the program information statements (as developed by Cloussieux and Snerdley in Tables 5-8, 5-9, and 5-10). The concept of a program crosswalk while initially developed to provide a basis for translating a traditional budget into programmatic terms, can also be used to provide budgetary information in more traditional line-item terms, i.e., to facilitate a "dual system" for budgeting.

TABLE 5-8

PROGRAM INFORMATION
POLICE INVESTIGATIONS

A. MISDEMEANORS

This category includes the investigation of offenses less serious than a felony and which go beyond the activities normally carried out by uniform officers.

	Last Fiscal Year	Current Budget	Next Fiscal Year
Work Data			
1. Full-time equivalent personnel	7.41	7.68	8.22
Measures of Efficiency			
2. Cost/FTE	$ 9,354	$ 9,423	$ 9,842
Measures of Effectiveness			
3. Compliance with standards			
4. Reduction in the percent of increase in the number of misdemeanors reported by three percent.			
Activity Cost			
5. Cost of Labor	$ 60,596	$ 64,043	$ 72,890
6. Cost of Materials	2,169	2,526	2,727
7. Cost of Equipment	6,551	5,798	5,283
8. Total Cost	$ 69,316	$ 72,367	$ 80,900

TABLE 5-9

PROGRAM INFORMATION
POLICE INVESTIGATIONS

B. FELONIES

This category includes the investigation of major crimes, such as murder, rape, arson, or burglary, and major violations or moral turpitude.

	Last Fiscal Year	Current Budget	Next Fiscal Year
Work Data			
1. Full-time equivalent Personnel	13.76	14.26	15.27
Measures of Efficiency			
2. Cost/FTE	$ 9,355	$ 9,425	$ 9,838
Measures of Effectiveness			
3. Compliance with standards			
4. Reduction in the absolute number of felonies reported by two percent per year.			
Activity Cost			
5. Cost of Labor	$112,534	$118,938	$135,350
6. Cost of Materials	4,028	4,692	5,063
7. Cost of Equipment	12,167	10,767	9,810
8. Total Cost	$128,729	$134,397	$150,223

TABLE 5-10

PROGRAM INFORMATION

POLICE INVESTIGATIONS

C. ADMINISTRATION AND SUPPORT

This category includes activities associated with the police laboratory which provides scientific assistance to all types of investigations; also included are the general administrative activities that support police investigations.

	Last Fiscal Year	Current Budget	Next Fiscal Year
Work Data			
1. Full-time equivalent personnel	11.33	11.73	12.52
Measures of Efficiency			
2. Cost/FTE	$ 9,495	$ 9,742	$ 9,782
Measures of Effectiveness			
3. Compliance with standards			
4. Fulfillment of good management practices			
Activity Cost			
5. Cost of Labor	$ 94,047	$101,133	$110,346
6. Cost of Materials	3,367	3,990	4,128
7. Cost of Equipment	10,167	9,154	7,997
8. Total Cost	$107,581	$114,277	$122,471

SCENARIO #4: PERFORMANCE/PROGRAM BUDGET CROSSWALK

Based on the experience gained under the LEAA grant in the development of a program budget format, the City Council has agreed to undertake program budgeting on a trial basis in order to obtain more effective information to assess the balance between revenues and expenditure needs in the various departments of city government. The ten programs and associated sub-programs initially identified by Inspector Cloussieux and Eric Snerdley have been adopted as the initial operating framework.

Your assignment is in the area of environmental enhancement and protection. One of the agencies that falls under this program category is the Rurbania Sewer and Water Utility Commission. Although the Commission operates as a special authority, i.e., is expected to be a self-supporting enterprise and is empowered to issue bonds secured by the revenues raised through user charges, its activities still fall within the general budgetary jurisdiction of the City Council.

Within the activities carried out by RSWUC, the following goals have been identified:

Water Services	To provide a safe water supply at adequate pressure and sufficient quantity to meet the demands of the domestic, commercial, and industrial users
Sewer Services	To operate and maintain a sewer system adequate to meet the domestic, commercial, and industrial needs of the county and to provide for the treatment of sewer-borne waste through the safe removal of liquid waste from the environment.

Table 5-11 provides a general summary of the operating expenditures for the RSWUC during the past fiscal year and the funds allocated for the current fiscal year. The agency is fairly labor intensive, with over 80 percent of its expenditures going in support of personnel (salaries and wages plus indirect costs). All new construction and expansion of existing facilities in recent years have been financed through special assessments, the issuance of revenue bonds, or from capital reserves. In the past, the RSWUC has been an important revenue producer for the city, showing a net income often in excess of $300,000. In recent years, however, this income margin has been severely reduced and user charges have not been increased to offset rising costs of operation.

Table 5-12 provides a statement of the work program for RSWUC and the personnel schedule for both the past fiscal year and the current year. Of the total direct personnel costs (salaries and wages plus overtime) of $1,232,000, 20.5 percent or $252,260 is budgeted for the current year in support of the administrative structure of the agency. The nine-member Board of Commissioners are elected for three year terms (with overlapping tenure) and each member receives $2,000 per year in compensation for his or her services (no fringe benefit charges are made on this expenditure). The Executive Director, his two Administrative Assistants, and the Accounting

TABLE 5-11

FUND:	DEPARTMENT:	DIVISION:
Special Revenues	Sewer and Water Utility Commission	

BUDGET COMMENTS

As a result of increased cost of operations and the addition of ten staff members, the budget request for the coming fiscal year is 13.48 percent, or $222,710, higher than the previous budget period.

Personal Services show an increased of $191,520 (14.25%). This increase is the result of ten new employees ($75,320), a 6.5 percent increase in the salaries of supervisory personnel and an 8.0 percent increase in the salaries of all non-supervisory personnel ($78,290), an increase of $34,705 in fringe benefits and other indirect costs, and a 7.2 percent ($3,205) increase in the overtime allowance.

Legal services increase by 9.68 percent ($1,500), while the cost of insurance increases by 5.0 percent ($1,875). A fifteen percent increase in the cost of fuel for power and pumping and an eight percent in other contractual services and in general materials and supplies will require an additional $26,680.

The allowance for uncollectable accounts has been increased by ten percent ($1,135).

Account Classifications	Past Fiscal Year	Current Budget
Personal Services		
110 Salaries and Wages	$1,030,930	$1,184,540
120 Overtime Allowance	44,255	47,460
130 Fringe Benefits & Unemployment Compensation	268,795	303,500
Subtotal: Personal Services	$1,343,980	$1,535,500
Contractual Services		
210 Utilities (Fuel)	$ 102,365	$ 117,720
220 Communications	355	383
230 Transportation	1,050	1,135
240 Advertising	0	0
250 Insurance	37,525	39,400
260 Dues & Subscriptions	0	0
270 Professional Services (Legal)	15,500	17,000
280 Maint. of Bldgs. & Improvements	*	*
290 Maint. of Equipment	29,075	31,400
295 Other Contractual Services	0	0
Subtotal: Contractual Services	$ 185,870	$ 207,038

*Included within personal services.

TABLE 5-11 (continued)

Account Classifications	Past Fiscal Year	Current Budget
Commodities		
310 Office Supplies	$ 8,733	$ 9,432
320 Clothing & Linens	--	--
330 Food, Drugs, Chemicals	25,433	27,468
340 Operating Supplies	24,094	26,022
350 Repair Parts	12,050	13,014
360 Operating Supplies-Equipment	23,148	25,000
370 Repair Parts--Equipment	12,037	13,000
380 Operating Supplies-Construct.	--	--
390 Minor Apparatus & Tools	5,580	6,026
Subtotal: Commodities	$ 111,075	$ 119,962
Capital Outlay (funded from separate accounts)		
Uncollectable Accounts	$ 11,365	$ 12,500
TOTAL	$1,652,290	$1,875,000

TABLE 5-12

FUND:	DEPARTMENT:	DIVISION:
Special Revenue	Sewer and Water Utility Commission	

WORK PROGRAM

It is the responsibility of the Rurbania Sewer and Water Utility Commission to develop, maintain, and operate reservoirs and wells, pumping stations, water purification facilities, and a water distribution system to provide an adequate potable water supply to the residents of Rurbania and to contract customers. The Commission also maintains and operates sewage treatment facilities to ensure the safe removal of liquid waste from the environment. The Commission provides various forms of customer services relating to the water supply and treatment responsibilities.

Position Title	Employees Last FY	Employees Current FY	Monthly Salary Range	Past Fiscal Year	Current Budget
Commissioner	9	9	--	$ 18,000	$ 18,000
Executive Director	1	1	--	18,100	19,300
Supervising Engineers	3	3	--	52,110	55,500
Pumping Station Chiefs	3	3	1125	38,025	40,500
Purification Supervis.	3	3	1125	38,025	40,500
Administra. Assistants	2	2	1042	23,475	25,000
Accounting Supervisor	1	1	1042	11,740	12,500
Crew Leaders	5	6	1000	55,500	72,000
Sewer Inspectors	4	4	900-990	42,720	46,140
Sanitation Engineers	4	4	875-950	42,240	45,000
Sewage Treatment Plant Supervisor	1	1	800-850	9,390	10,000
Reservoir Supervisor	1	1	800-850	9,390	10,000
Meter Supervisor	2	2	790-840	18,480	19,680
Accountant III	5	6	700-810	43,975	57,000
Operations & Maintenance Personnel	57	62	525-835	402,320	469,200
Clerk-Stenographers	4	4	620-680	28,890	31,200
Engineering Aides	6	6	600-660	42,000	45,360
Meter Readers	7	8	550-600	45,360	56,000
Clerk-Typists	3	4	510-560	18,000	26,000
Billing Clerks	7	8	470-520	38,850	48,000
Custodians	4	4	400-430	18,520	22,400
Receptionist	1	1	330-370	3,960	4,280
Computer Operator	1	1	900-998	11,860	10,980
Subtotals	134	144		$1,030,930	$1,184,540
Add:					
Overtime Allowance				44,255	47,460
Fringe Benefits & Unemployment Comp.				268,795	303,500
TOTAL				$1,343,980	$1,535,000

Supervisor are responsible for the overall administration of the agency, assisted by a staff of 24 office personnel (accountants, clerk-stenos, clerk-typists, billing clerks, and a receptionist), including a computer operator who works on the RSWUC data and accounts in central data processing.

The chief technical personnel include three supervising engineers, three supervisors of the pumping stations facilities (operating on eight-hour shifts), three purification treatment plant supervisors (also operating on eight hour shifts), a sewage treatment plant supervisor, and a reservoir supervisor (who resides at the reservoir site some 12 miles from the purification plant).

Six crew leaders are responsible for the activities associated with the operation and maintenance of water transmission and distribution lines, while the four sewer inspectors and four sanitation engineers serve a similar function for the sewer lines. There are also six engineering aides and sixty-two salaried and wage personnel in Operations and Maintenance. Four custodians are assigned to provide general property maintenance. Eight meter readers work under the direction of two meter supervisors, who are also responsible for the installation and maintenance of meters and for other general customer services.

While the majority of operations and maintenance personnel work on a regular 8 to 5 basis, skeleton crews operate on the 5 to 12 and 12 to 8 shifts to take care of any emergency situations. During the past fiscal year, some $44,255 were paid in overtime; $47,460 have been budgeted for overtime payments during the current fiscal year. While only O & M personnel are now eligible for overtime, various supervisory field personnel have argued that they should also receive these benefits.

All personnel (other than supervisory positions) are guaranteed an annual cost-of-living increase in salary, which for the current fiscal year amounted to eight percent over the previous FY levels. Supervisory personnel must negotiate their salaries each year; for the current fiscal year, supervisory personnel averaged a 6.5 percent increase over last year's levels.

Table 5-13 provides an identification of expenditures for materials and supplies according to the major facilities operated by the Commission. These data were compiled from the records of central purchasing, from purchase vouchers, billing records, etc., which were then inflated to reflect current budget allocations. The largest item of expenditure is that of fuel for the power and pumping facilities ($117,720); this figure is 15 percent higher than the previous fiscal year. It has been estimated that, with the increase in fuel costs in general, these expenditures could be as much as 20 percent higher for the coming fiscal year. Chemical required for purification of water and treatment of sewage have also increased in cost due to inflation. These costs are up 8 percent from the previous year and are estimated to be up an additional 10 percent in the next fiscal year.

TABLE 5-13.--Materials, Supplies, and Related Expenses

Supplies		$ 89,440
Water Supply Source	$ 5,728	
Power & Pumping Stations	18,312	
Purification Supplies	27,468	
Sewage Treatment Plant	28,500	
General Office Supplies	9,432	
Materials		$ 63,440
Water Supply Source	$21,000	
Maintenance & Improvements	10,470	
Sewage Treatment Plant	31,970	
Fuel for Power and Pumping		$117,720
Total		$270,600

Work performance data currently are unavailable for the operations of the Sewer and Water Utility Commission. Therefore, there is no established basis upon which to assign man-hours of various personnel in the pursuit of their activities to provide a further foundation for a program structure and analysis. The executive Director, however, has recently established a "time and effort" report, and through this reporting system, further insights can be gained as to the distribution of time typically spent by staff members on the various functional areas for which they have responsibility. The data presented in Tables 5-14, 5-15, and 5-16 are for the month of September (20 work days or 160 work hours).

Table 5-14 provides a record of the time spend by Engineering Personnel in: (a) operational activities, and (b) maintenance. From these data, it may be seen that the majority of the time of the Supervising Engineers and the Engineering Aides is spent in operational activities (75%). The Sanitation Engineers devote approximately two-third of their time to the treatment facility.

These data are further subdivided into five basic categories: (1) work associated with the operations and maintenance of the water supply sources (the principal supply source is the city reservoir; additional supplemental supply is provided by a series of public wells); (2) activities focusing on the power and pumping facilities (whereby water is transmitted from the reservoir or wells to the purification plant and sewage is pumped to the treatment plant); (3) the engineering work occasioned by the operations and

TABLE 5-14. Monthly Time Distribution & Annual Dollar Equivalents Engineering Personnel

	Hours	% of Time	Dollar X 12	Total
Supervising Engineers				
Operations				
Supply Sources	72.0	20.0	$ 693.75	$ 8,325.00
Power & Pumping	48.0	13.3	462.50	5,550.00
Purification	57.6	16.0	555.00	6,660.00
Transmission	62.4	17.4	601.25	7,215.00
Treatment	120.0	33.3	1,156.25	13,875.00
Subtotals	360.0	100.0	$3,468.75	$41,625.00
Maintenance				
Supply Sources	24.0	20.0	$ 231.25	$ 2,775.00
Power & Pumping	4.8	4.0	46.25	555.00
Purification	22.4	18.7	215.83	2,590.00
Transmission	28.8	24.0	277.50	3,330.00
Treatment	40.0	33.3	385.42	4,625.00
Subtotals	120.0	100.0	$1,156.25	$13,875.00
Engineering Aides				
Operations				
Supply Sources	144.0	20.0	$ 567.00	$ 6,804.00
Power & Pumping	96.0	13.3	378.00	4,536.00
Purification	115.4	16.0	454.39	5,452.65
Transmission	124.6	17.4	490.61	5,887.35
Treatment	240.0	33.3	945.00	11,340.00
Subtotals	720.0	100.0	$2,835.00	$34,020.00
Maintenance				
Supply Sources	48.0	20.0	$ 189.00	$ 2,268.00
Power & Pumping	9.6	4.0	37.80	453.60
Purification	44.8	18.7	176.40	2,116.80
Transmission	57.6	24.0	226.80	2,721.60
Treatment	80.0	33.3	315.00	3,780.00
Subtotals	240.00	100.0	$ 945.00	$11,340.00
Sanitation Engineers				
Treatment	420.0	65.6	$2,460.94	$29,531.28
Line Maintenance	220.0	34.4	1,289.06	15,468.72
Subtotals	640.0	100.0	$3,750.00	$45,000.00

TABLE 5-15.--Monthly Time Distribution & Annual Dollar Equivalents Operations & Maintenance Supervisory Personnel

	Hours	Time	Dollars x 12	Total
Pumping Station Chiefs				
Operations	384.0	80.0	$2,700.00	$32,400.00
Maintenance	96.0	20.0	675.00	8,100.00
Purification Supervis.				
Operations	360.00	75.0	$2,531.25	$30,375.00
Maintenance	120.0	25.0	843.75	10,125.00
Crew Leaders				
Operations	576.0	60.0	$3,600.00	$43,200.00
Maintenance	384.0	40.0	2,400.00	28,800.00
Sewer Inspectors				
Operations	200.0	31.2	$1,201.56	$14,418.72
Maintenance	440.0	68.8	2,643.44	31,721.28
Sewage Treatment Plant Supervisor				
Operations	120.0	75.0	$ 625.00	$ 7,500.00
Maintenance	40.0	25.0	208.33	2,500.00
Reservoir Supervis.				
Operations	136.0	85.0	$ 708.33	$ 8,500.00
Maintenance	24.0	15.0	125.00	1,500.00

maintenance of the purification plant; (4) the engineering requirements of the transmission and distribution lines; and (5) engineering work at the sewage treatment plant. The sanitation engineers' work focuses on: (1) the sewage treatment plant; and (2) the maintenance of the sewer lines.

Table 5-16 provides a record of similar data for the Operations and Maintenance Supervisory Personnel. While the various supervisory personnel have principal responsibilities in one functional area, the remaining 62 members of the labor force evidence variable time distributions between six functional areas.

Since O & M personnel (other than supervisory positions) are eligible for overtime payments, it also is necessary to record these charges. To simplify the calculations in converting these data to annual dollar equivalents, an average hourly rate of $3.94 has been applied to regular hours and an average overtime rate of $5.91 per hour (time-and-a-half) has been derived. All calculations in Table F have been rounded to the nearest whole dollar. These average hourly rates were arrived at by assuming that each of the

TABLE 5-16.--Monthly Time Distribution & Annual Dollar Equivalents for Other Operations and Maintenance Personnel

	Hours	Dollars*	Overtime Hours	Dollars*	Total Dollars x 12	Total
Operations						
Supply Sources	2200	$ 8,670	144.8	$ 856	$ 9,526	$114,312
Power & Pumping	1600	6,307	107.1	633	6,940	83,280
Purification	440	1,734	29.1	172	1,906	22,872
Transmission	160	631	11.7	69	700	8,400
Treatment	1640	6,464	84.5	499	6,963	83,556
Subtotals	6040	$23,806	377.2	$2,229	$26,035	$312,420
Maintenance						
Supply Sources	320	$ 1,261	22.1	$ 131	$ 1,392	$ 16,704
Power & Pumping	32	126	1.7	10	136	1,632
Purification	48	189	5.1	30	219	2,628
Transmission	160	631	9.4	56	687	8,244
Treatment	1600	6,307	120.0	709	7,016	84,192
Sewer Lines	1720	6,780	133.7	790	7,570	90,840
Subtotals	3880	$15,294	292.0	$1,726	$17,020	$204,240
TOTALS	9920	$39,100	669.2	$3,955	$43,055	$516,660

*Rounded to the nearest whole dollar.

sixty-two employees work a total of 1920 manhours per year (allowing for holidays, vacations, sick days, etc.) or a total of 119,040 man-hours for the 62 workers. The total salaries of these workers was then divided by total man-hours.

Table 5-17 provides an estimate of the pro-rata distribution of custodian costs among three functional areas and administrative facilities. No custodian services are provided at the reservoir site.

TABLE 5-17.--Pro-Rata Distribution of Custodian Costs

Facility	Man-Hours	Dollars
Power and Pumping Facilities	1152	$ 3,360
Purification Plant	1152	3,360
Treatment Plant	1152	3,360
Administrative Facilities	4224	12,320
Totals	7680	$22,400

The Executive Director has requested six new positions for the coming year. These position requests include: (1) two entrance level operations and maintenance personnel, (2) an additional meter reader, (3) a billing clerk, (4) an engineering aide, and (5) additional computer support (half-time position).

With the data vailable in Tables 5-11 through 5-17, supplemented by the scenario narrative, you should be in a position to prepare a detailed program statement of operating expenditures for the next fiscal year, showing a breakdown of costs according to major sub-programs and program elements. In developing the presentation, you may use the format that Cloussieux and Snerdley followed or any other appropriate format that clearly illustrates the program elements and subprograms and their related costs.

INSTRUCTIONAL GUIDE #4: PERFORMANCE/PROGRAM BUDGET CROSSWALK

Several approaches might be adopted in the preparation of a crosswalk from the traditional object of expenditures (line-item) budget of the Rurbania Sewer and Water Utility Commission to a program budget format. One approach would be to project the objects of expenditures in the current budget to the next fiscal year and then to convert these expenditure categories into programmatic terms. A second approach would be to develop the program structure based on current data and then project the resulting program elements to appropriate levels for the next fiscal year. A third approach (adopted herein) would be to organize the available data for the current fiscal year into programmatic terms, retaining the objects of expenditures as components of the various program activities, and then to project the data to next fiscal year levels. This third approach, in effect, results in a dual system that retains the control features of the traditional budget format, while presenting budget data in programmatic terms.

As shown on the following page, three sub-programs were designated to encompass the activities of the Rurbania Sewer and Water Utility Commission. Two of these sub-programs were adopted directly from the program structure identified in the case study. The third category--administration and support--represents a partial sub-program in that other cost factors would be included in this sub-program in the final program budget summary for the program of Environmental Enhancement and Protection.

As the sub-program summary reveals, total operating costs for the activities of RSWUC are anticipated to increase by 11.2 percent, from $1,875,000 in the current fiscal year to $2,085,290 in the coming fiscal year. The increase for water services is slightly higher than the overall increase (11.65%), while the anticipated increase in sewer service costs is significantly lower (10.1%) than the overall increase. The highest percentage increase is anticipated in the administration and support category, which includes the unassigned activities associated with power and pumping; as a consequence of rising fuel costs (projected at 20 percent over current levels), this sub-program is expected to increase by 11.73 percent.

The requested increase in personnel of 5.5 FTE positions represents a 3.8 percent rise over current levels. Labor costs are expected to increase by 10.97 percent, slightly below the overall rate of increase in operating costs. Average labor costs, however, are projected to increase by only 6.88 percent, from $10,663.19 per FTE in the current (budget) year to $11,397.32 per FTE in the next (projected) fiscal year. Therefore, over one-third of the increase in labor costs can be attributed to increases in staff and additional hours of overtime anticipated.

As might be anticipated, the cost category exhibiting the greatest relative increase is the cost of materials (16.07%) which includes the major item of fuel costs for power and pumping. Supply

Table 5-18

CITY OF RURBANIA SUMMARY OF EXPENDITURES		
PROGRAM: Environmental Enhancement and Protection	SUB-PROGRAM: Water & Sewer Services	PROGRAM ELEMENT: All
Sub-Programs	Current Fiscal Year	Next Fiscal Year
Water Services	$ 735,427.75	$ 821,139.86
Sewer Services	552,155.00	607,840.71
Administration and Support	587,417.25	656,309.44
TOTALS	$1,875,000.00	$2,085,290.00

costs are projected to increase by 8.79 percent, while other costs (insurance, legal fees, and uncollectable accounts) will increase by 7.14 percent. The cost per FTE (the measure of efficiency) is projected to increase by 6.56 percent, suggesting that the

Table 5-19

PROGRAM INFORMATION

WATER & SEWER SERVICES

	Current Fiscal Year	Next Fiscal Year
Work Data		
1. Full-time equivalent personnel	144.00	149.50
Measures of Efficiency		
2. Cost*/FTE	$ 12,203.33	$ 13,003.55
Activity Costs		
5. Cost of Labor	$1,535,500.00	$1,703,900.00
6. Cost of Supplies	89,440.00	97,300.00
7. Cost of Materials	181,160.00	210,270.00
8. Other Costs	68,900.00	73,820.00
9. Total Costs	$1,875,000.00	$2,085,290.00

*Excludes fuel costs.

Commission will be operating on a more efficient basis in the coming year than in the current fiscal year. Even when fuel costs are included in these measures of efficiency, the increase is only 7.12 percent.

The Commission's activities will continue to be highly labor-intensive, with 81.7 percent of all costs accounted for by salaries and wages and overhead (fringe benefits and unemployment compensation). The cost of materials will account for 10.08 percent of the total costs in the next fiscal year (as compared to 9.67 percent), the cost of supplies will decline slightly in terms of impact on total costs (from 4.77 percent to 4.67 percent in the coming year).

The summary of expenditures on the next three pages illustrate the program elements identified under each of the sub-programs. The water services sub-program was organized around five program elements: supply sources, purification, water transmission, customer services (metering and billing), and power and pumping. This latter program element was also identified in conjunction with sewer services, and since data were unavailable to prorate these costs on any defensible basic, this element was designated "unassignable" and listed under Administration and Support. Future refinements in the program structure for these activities would dictate that the costs associated with power and pumping be included under each sub-program as appropriate data become available to make these assignments.

Sewer services were organized around two basic program elements: sewage treatment and sewer line maintenance, while the administration and support sub-program includes general administration and power and pumping. Further subdivision of general administration might be possible in the future as the program structure is further refined.

Table 5-20.--Percent of Total and Percent Increases for Water Services Program Elements

Program Element	Percent of Total		Percent Increase
	Current	Next FY	
Supply Sources	31.03	30.81	10.84
Purification	17.81	17.49	9.65
Water Transmission	18.32	18.00	9.72
Customer Services	32.84	33.70	14.59
All Elements	100.00	100.00	11.65

As shown in Table 5-20, total costs for water services are projected to increase by 11.65 percent, with the largest increase (14.59%) coming in the cost of customer services. This element will account for 33.7 percent of total costs followed by supply sources costs at 30.8 percent of total costs.

With relatively small increases in the costs of supplies and materials, the measure of efficiency shows an increase of only 6.0 percent, in spite of an addition of 3.23 FTE positions in this subprogram. The cost of labor is expected to rise by 11.84 percent in this sub-program.

Table 5-21

CITY OF RURBANIA

SUMMARY OF EXPENDITURES

PROGRAM:	SUB-PROGRAM:	PROGRAM ELEMENT:
Environmental Enhancement and Protection	Water Services	All

Program Element	Current Fiscal Year	Next Fiscal Year
Supply Sources	$ 228,213.00	$ 252,962.00
Purification	130.992.31	143,631.94
Water Transmission	134,747.44	147,845.92
Customer Services	241,475.00	276,700.00
(Power & Pumping)	*	*
TOTALS	$ 735,427.75	$ 821,139.86

*All power and pumping costs have been included in the sub-program Administration and Support.

Table 5-22

PROGRAM INFORMATION

WATER SERVICES

	Current Fiscal Year	Next Fiscal Year
Work Data		
1. Full-time equivalent personnel	60.81	64.04
Measures of Efficiency		
2. Cost/FTE	$ 12,093.86	$ 12,822.30
Activity Costs		
5. Cost of Labor	$ 681,231.75	$ 761,877.86
6. Cost of Supplies	33,196.00	36,418.00
7. Cost of Materials	21,000.00	22,844.00
8. Total Costs	$ 735,427.75	$ 821,139.86

Table 5-23

CITY OF RURBANIA

SUMMARY OF EXPENDITURES

PROGRAM: Environmental Enhancement and Protection	SUB-PROGRAM: Sewer Services	PROGRAM ELEMENT: All

Program Element	Current Fiscal Year	Next Fiscal Year
Sewage Treatment	$ 361.594.10	$ 399,039.46
Sewer Line Maintenance	190,560.90	208,801.25
(Power & Pumping)	*	*
TOTALS	$ 552,155.00	$ 607,840.71

*All power and pumping costs have been included in the sub-program Administration and Support.

Table 5-24

PROGRAM INFORMATION

SEWER SERVICES

	Current Fiscal Year	Next Fiscal Year
Work Data		
1. Full-time equivalent personnel	43.01	44.33
Measures of Efficiency		
2. Cost/FTE	$ 12,837.83	$ 13,711.72
Activity Costs		
5. Cost of Labor	$ 491,685.00	$ 542,199.71
6. Cost of Supplies	28,500.00	30,865.00
7. Cost of Materials	31,970.00	34,776.00
8. Total Costs	552,155.00	607,840.71

Table 5-25

CITY OF RURBANIA SUMMARY OF EXPENDITURES		
PROGRAM: Environmental Enhancement and Protection	SUB-PROGRAM: Administration and Support	PROGRAM ELEMENT: All
Program Element	Current Fiscal Year	Next Fiscal Year
General Administration	$ 280,752.00	$ 307,713.75
Power & Pumping	306,665.25	348,595.69
TOTALS	$ 587,417.25	$ 656,309.44

Table 5-26

PROGRAM INFORMATION ADMINISTRATION AND SUPPORT		
	Current Fiscal Year	Next Fiscal Year
Work Data		
1. Full-time equivalent personnel	40.19	41.13
Measures of Efficiency		
2. Cost*/FTE	$ 11,686.92	$ 12,522.48
Activity Costs		
5. Cost of Labor	$ 362,583.25	$ 399,822.44
6. Cost of Supplies	27,744.00	30,017.00
7. Cost of Materials	128,190.00	152,650.00
8. Other Costs	68,900.00	73,820.00
9. Total Costs	$ 587,417.25	$ 656,309.44

*Excludes fuel costs.

The preceding narrative illustrates the type of analysis possible based on the programmatic format adopted for this budget presentation. As noted previously, this dual budgetary system affords the advantages of both programmatic analysis and personnel/position controls. A chart of personnel could be drawn from these data with little difficulty should such information be deemed desirable for management purposes.

Similar analyses could be developed for each of the sub-program and for the program elements. Program activities and component activity costs (objects of expenditure) could be delineated for each of the eight program elements. Two basic program activities--operations and maintenance--might be maintained where possible based on the data available in the scenario. Further refinements in these activity classifications would be desirable as more data are developed (in cost accounting terms). Under each activity the position titles assigned to these elements could be listed, with a subtotal provided for salaries and wages. Overhead (fringe benefits and unemployment compensation) represents a fixed 25 percent of salaries and wages and should be assigned to each program element where it is generated, rather than aggregated in a single category. Variations in fringe benefits (where this practice occurs) must be reflected in this manner (in the present scenario, overhead does not vary in relative terms between fiscal periods, although adjustments might be required in future years). Subtotals could be provided for each program activity and a total cost could be shown for each program element.

ENDNOTES

1. An excellent introduction to PPBS at the local level is provided by Selma J. Mushkin, "PPB for the Cities: Problems and the Next Steps," in Financing the Metropolis, edited by John P. Crecine, Urban Affairs Annual Review, Vol. 4 (Beverly Hills: Sage Publications, 1970).

2. David Novick, Current Practices in Program Budgeting (PPBS): Analysis and Case Studies Covering Government and Business (New York: Crane, Russak and Company, 1973), p. 13.

3. Ibid., p. 51.

4. Alan Walter Steiss, Public Budgeting and Management (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1972), chapter 9. The techniques of strategic planning are described in a separate module in this NTDS curriculum package.

5. Robert D. Lee, Jr. and Ronald W. Johnson, Public Budgeting Systems (Baltimore: University Park Press, 1973), p. 168.

6. S. Kenneth Howard, Changing State Budgeting (Lexington, Ky.: Council of State Governments, 1973), p. 260.

7. Bureau of the Budget, Executive Office of the President, "Planning-Programming-Budgeting (PPB) System," Bulletin No. 68-9 (April 12, 1968), p. 4.

8. Donald A. Krueckeberg and Arthur L. Silvers, Urban Planning Analysis (New York: John Wiley & Sons, 1974), p. 198.

9. Steiss, op. cit., p. 157.

10. John F. Due and Ann Friedlaender, Government Finance--Economic of the Public Sector (Homeville, Ill.: Richard D. Irwin, 1973), pp. 59-60.

11. For a further discussion of these points, see: Alan Walter Steiss, Local Government Finance: Capital Facilities Planning and Debt Administration (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1975), chapter 11.

12. The use of this terminology in state government is reflected in Jimmy Carter's call for a mission-oriented budget structure at the federal level upon taking office as President. Under his leadership as Governor, the State of Georgia adopted a program budget format that contained the categories outlined in this discussion.

13. Frederick C. Mosher, Program Budgeting: Theory and Practice (Chicago: Public Administration Service, 1954), p. 59.

14. Graeme M. Taylor, "Designing the Program Structure," in Program Budgeting and Benefit-Cost Analysis (Pacific Palisades, Calif.: Goodyear Publishing Co., 1969), p. 42.

15. Procedures for the articulation of agency goals and objectives that seek to ensure this "bottom up" perspective are discussed in a separate curriculum module in this servies dealing with Management By Objectives (MBO).

16. Leonard Merewitz and Stephen H. Sosnick, The Budget's New Clothes (Chicago: Markham Publishing Co., 1971), pp. 65-71; Verne B. Lewis, "Towards a Theory of Budgeting," in Planning Programming Budgeting, edited by Fremont J. Lyden and Ernest G. Miller (Chicago: Markham Publishing Co., 1968), pp. 128ff; and Herbert A. Simon, Administrative Behavior (New York: The Macmillan Company, 1957), 2nd ed., pp. 192-197.

CHAPTER 6

ANALYTICAL APPROACHES IN PUBLIC BUDGETING

The problem of allocating scarce resources to achieve certain specified objectives is as old as mankind. In theory, the problem is quite simple--after determining what is wanted (specification of objectives), these wants are measured (quantification of benefits sought), and available resources are then applied to achieve the greatest possible value of the identified wants (maximization of benefits). It is only in practice that these resources are allocated through the budget process. Therefore, the budget problem is one of maximizing benefits (once specified and quantified) for any given set of fiscal inputs (i.e., specified and quantified costs).

All too often the budget process has been dominated by a "money first" perspective; expenditures often are confined to only the amount of revenue immediately available regardless of identified needs. Alternatively, an "absolute needs" approach has resulted in certain programs being undertaken regardless of cost or of the fiscal impacts on other public needs. As the scope of governmental activities has expanded, however, more thorough evaluations of both costs and benefits and the factors contributing to their generation have become increasingly important to the effective allocation of scarce public resources. As a consequence, haphazard approaches have begun to give way to more systematic and comprehensive forms of budget analysis.

AVAILABLE METHODS AND TECHNIQUES

The spectrum of methodology available to the budget analyst points up both the potentials and limiations of these more systematic approaches. For the most part, intuitive judgment and experience continue to play a critical role in major allocation decisions. Therefore, the anlayst must recognize the extent to which these factors can be taken into account (or fail to be taken into account) by these more systematic approaches.

If various analytical approaches are viewed in relation to their real-world applications, a continuum based on abstraction and optimization can be identified. Increasing the level of abstraction involved in analysis results in increases in the applicability of quantifiable data, while increasing the realism of the models increases the complexity and the degree of risk and uncertainty involved.

At one end of this continuum are such analytical techniques as simple feedback/evaluation mechanisms (work-efficiency and unit cost measures), network analysis methods (PERT and CPM) used in work programming and operations control, and the methodologies of operations research. All of these techniques are highly dependent upon empirical data and tend to "suboptimize" in terms of broader systems concerns. It is at this end of the continuum, however, that much of the success of application and relative sophistication in calculations are to be found.

At the opposite end of the continuum are the more comprehensive models that attempt to deal with complex, real-world situations in a "grand optimization" context. The use of qualitative information and a priori deductions in such fields as General Systems Theory and Cybernetics, however, serves to limit their present capabilities of measurement.[1]

Near the middle of this continuum are the basic models of systems analysis, economic decision-making techniques, and the approaches to cost-benefit/effectiveness analyses. The major thrust of these analytical techniques is toward suboptimization within a fairly well-defined range of quantification. These middle-range approaches, however, are being applied with increasing frequency in budget analysis.

Various analytical models are the subject of much more detailed examination in other modules of this NTDS series on policy/program analysis and evaluation techniques. The purpose of the present discussion will be to explore the more specific application of several of these techniques in the processes of budget analysis.

WORK PROGRAMMING AND OPERATIONS CONTROL

A high degree of inefficiency continues to plague the programming and implementation of governmental operations. Although the general administrative objectives of economy and efficiency have been a watchword in public budgeting since the early thirties, readily available evidence of the above indictment can be found in: (1) the number of project deadlines that are missed, often because they are unrealistic in view of the budget and scope of work, (2) public programs which require substantial extensions to accomplish their objectives or which are dropped because they fail to show adequate results in the anticipated time period or funding allocations (again the problem may be an unrealistic time schedule or level of resources for accomplishment), and (3) the familiar practice of omitting work items from a project schedule in order to meet overall work deadlines or to conform to budget constraints.

New management techniques must be employed if public agencies are to achieve the objectives of greater effectiveness and efficiency in carrying out their ever-increasing responsibilities. In this connection, the techniques of work programming and operations control are particularly pertinent.

PERT/CPM: The Basis for Effective Work Programming

Work programming or operations planning involves a determination of requirements for program resources and their necessary order of commitment in the various activities that must be performed to achieve program objectives. Such techniques as PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) were developed in industry and in the military in recognition of the need for better program management--for better operations planning and control. These techniques are euqally applicable to the planning, programming, monitoring, and control of any type of public program provided the following concepts are continually kept in mind:

(1) Planning and programming must be geared to the operations to be performed, that is, the work plan must be *activity oriented*.

(2) Reporting can be geared either to the completion (whole or part) of activities or to the arrival at *milestones* in the program; however, if a milestone orientation is selected, such a system can be properly established only from an *activity-oriented work plan*.

These two points must be underlined from the outset, since the failure of these techniques in application to governmental programs often arises from a failure on the part of budget analysts and program managers to recognize the need to express public programs in activity terms. This failure, in turn, may be traced to an inability (or reluctance) of public management to think in terms of strict time constraints. Although time frequently is overlooked as a public program resources, it may prove to be the most valuable of all resources and the one to be "spent" most wisely. Business management has long recognized that "getting something done" requires a concomitant specification of a time period for accomplishment. Many governmental agencies have been slow to recognize and adopt this parallel requirement for public programs.

Since PERT and CPM first appeared in the late fifties, their apparent differences have all but disappeared. In fact, features of one technique have been incorporated into the other. The arrow diagram or "network", si common to both methods. Differences may appear in the calculations made and in the emphasis placed on various aspects of the network. Variations in application, however, may be greater than the actual differences between the techniques themselves. The important point is that a work program or operations plan be created from which realistic time schedules and budget requirements can then be prepared.

While many of the techniques and concepts associated with CPM have been incorporated into PERT (e.g., it is possible to identify a "critical path" in the development of a PERT network), the Critical Path Method stands on its own merits as a work programming device. PERT techniques require substantially more sophistication in computer hardware and software. Therefore, for the purposes of work programming and operations control in the budget processes of local government, CPM would seem to offer greater promise, especially in those cases where no previous computer programming experience is evident.[2]

Criteria for Budgeting and Management

In the development and analysis of budget estimates and in the subsequent management of budget allocations, three fundamental elements of any public program or project must be considered:

(1) Operations: the things which must be done (activities or jobs), each with a sequential relation to all other operations; any undertaking that uses resources for some period and involves costs may be considered an operation.

(2) Resources: the things utilized in a program, normally reduced to a common standard of cost, but including men, machines, material, money, and time.

(3) Constraints: conditions imposed by outside factors such as completion dates, resource limits, inputs from other sources, and so forth.

If operations are to be programmed, budgeted, and controlled effectively, these diverse and often contradictory elements must be coordinated into an operations plan that will permit the various work activities to be completed (or maintained) in the "best" time, at the least cost, and with the smallest degree of risk. This plan must be dynamic--it must provide the ability to: (1) consider the costs of several alternative approaches in dollars and time; (2) establish criteria for allocating and scheduling resources; (3) provide guidelines for evaluating the accuracy of time and cost estimates and assist in refining these estimates for later use; (4) understand and evaluate without delay the effect of change; (5) revise and update the plan on a real-time basis; and (6) provide a vehicle for the communication and assimilation of data. Deviations between predicted and actual results must be identified quickly so that management can take the necessary action to adjust the work program and, if necessary, the funding support.

The Critical Path Method--developed from more detailed bar charts and time-line diagrams which were job or activity-oriented--can assist management in achieving these objectives. By linking jobs or activities together in a sequence of dependence, an arrow diagram or "network" is produced. Using this network of relationships, resources can be assigned and contraints identified. It is also possible to determine from the CPM diagram if an operation (job or activity) is ahead, behind, or on schedule while it is in progress.

The function of work programming is to provide the mechanisms for more systematic control so that management only need be called in when the program or project may be off schedule or otherwise in trouble--a practice known as management by exception. Exceptions are the deviations or differences between what management anticipates will happen (or what is scheduled to happen) and what actually does happen. Dynamic control involves the initiation of corrective actions within the appropriate time necessary to make such action useful and meaningful.

Many factors combine to provide this kind of control, but none is more important than communications. PERT and CPM are excellent tools of communication because they show graphically the interrelationships of all activities in a program and indicate clearly where responsibilities for supervision and management lie. The amount of progress reporting is thereby reduced. When a change in plan or schedule is required, there is no need to inform everyone who is charged with responsibility because the network should show clearly which activities will be affected by any change. This feature can relieve field staff of much unnecessary paper work that only serves to keep them from their more valuable function--the continuous supervision of program activities.

Establishing a Program Schedule

PERT and CPM are not scheduling techniques. Once the critical path is determined, a program schedule must be developed by examining resource requirements and availability, task or job sequences, and possible starting times for various program activities. A program schedule provides the basis for budget estimates and allocations. Once the schedule is produced, it can be displayed diagrammatically on a time scale basis and thereby, provides a mechanism for control and evaluation during the implementation of the program activities. The steps required to convert a work program or operations plan to a program schedule are summarized in Figure 6-1.

In producing any schedule, the requirement is to level the use of resources. This is accomplished by selecting the "best" starting time for each activity. Thus, in developing a schedule, the longest path in a program or project (i.e., the critical path) is determined not so much by the duration of the various activities, but by the segment of resources (men, equipment, funds, etc.) that can be assigned out of the total resource capacity in order to complete each activity.

The requirement of scheduling, therefore, is to establish a duration for each activity with varying levels of resources to be utilized so that it is still within the limits of peak efficiency. This yields a minimum cost for the activity. It then is possible to take the minimum duration, with a resultant maximum use of resources, and perform the critical path calculations with the estimates of activity duration. These procedures will yield a minimum

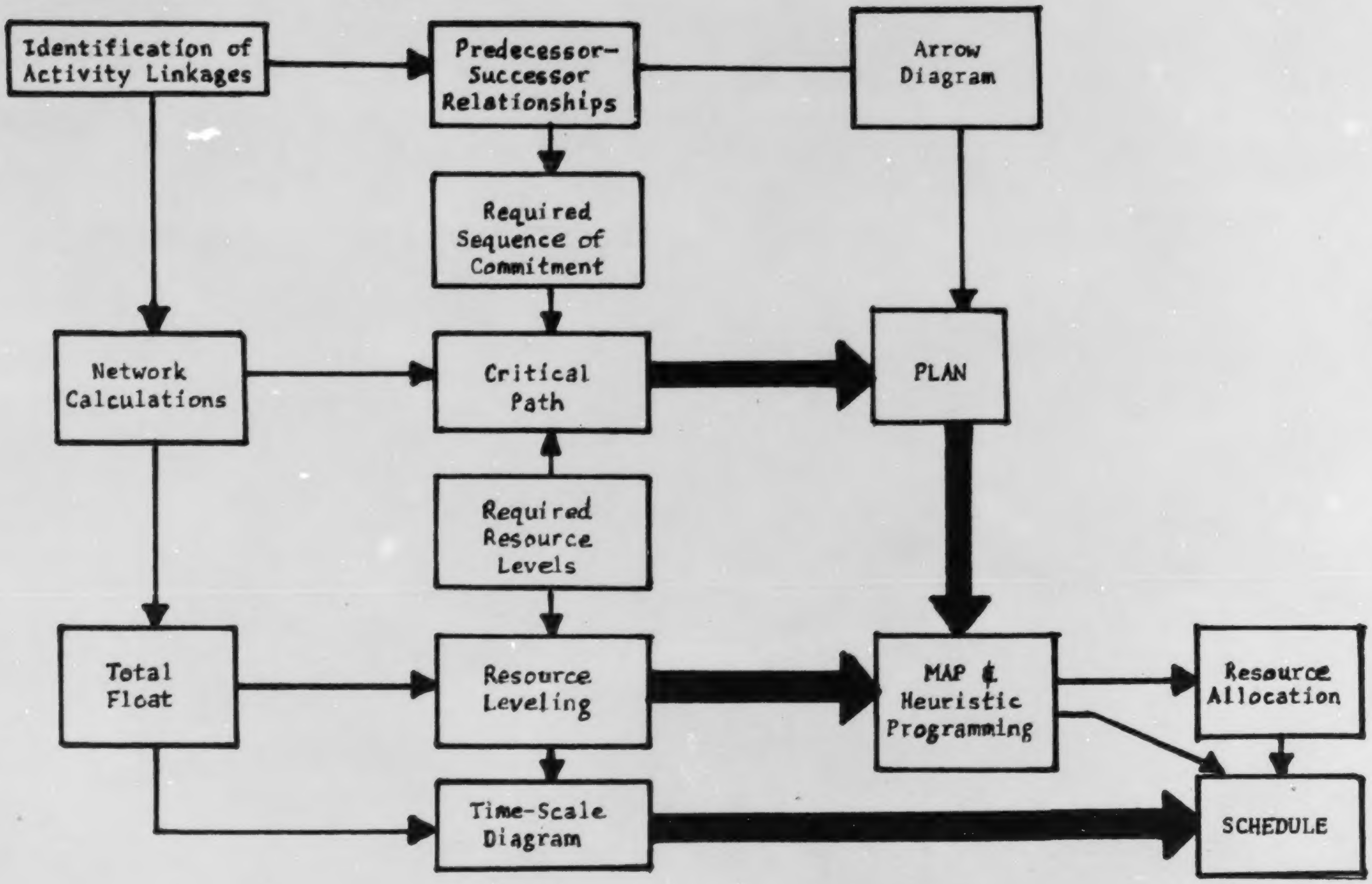
Identification of Activity Linkages
Predecessor-Successor Relationships
Arrow Diagram
Required Sequence of Commitment
Network Calculations
Critical Path
PLAN
Required Resource Levels
Total Float
Resource Leveling
MAP & Heuristic Programming
Resource Allocation
Time-Scale Diagram
SCHEDULE

Figure 6-1. Steps in Developing a Schedule.

duration for the program or project; however, it may result in personnel and equipment requirements which exceed the capabilities of available resources.

Once management has approved a schedule, a time scale diagram can be drawn which provides a visual assimulation of the program for all levels of management. Progress reports can be posted on the diagram at regular intervals, and the actual results compared with the estimates or exceptions from the original plan. Management thus is equipped with specific knowledge of the situation and is in a position to act. There is no need to wade through a sea of irrelevant data to find that everything is running smoothly.

In the final analysis, however, these techniques are still tools that are only as good as the managers who use them. A systematic approach to work programming and operations control cannot make decisions--this responsibility must remain with public officials and program managers. These techniques can provide better information on which to base these decisions, however. Work programming is not a substitute for effective program supervision, but it will show where responsibilities are not being met. Best of all, these are relatively simple techniques to learn and use and can provide improved communications at all levels of program and project management.

Applications in the Public Sector

Many public officials and technicians have resisted the application of these analytical techniques to the programming and scheduling of public activities, arguing that there are too many subjective variables and too much uncertainty in such undertakings to permit their effective use. More time and money would be spent in their application, the critics assert, than could be justified by the improved efficiency in performance.

There are two significant fallacies associated with these arguments: (1) the assumption that these methods will do everything; and (2) the assumption that they can be of no help. These techniques, at times, have been criticized because they cannot prevent such problems as missed target dates established for complex research projects, cost overruns, or avert delays due to bad weather conditions or other natural causes. The fact of the matter is that no method will ever eliminate or prevent these problems or program management. The idea is to attack problems of this sort methodically: this is the essence of good management. To assert, on the other hand, that real use cannot be made of these methods in the public sector is to ignore the many occasions on which they have been of significant assistance in programs both large and small in the private sector. The real problem seems to be not whether these methods are useful--the validity of their application has been proven--but, rather, whether public sector personnel will learn to use them.

The frequently heard argument that techniques developed for private enterprise are not applicable directly to public activities--particularly non-product oriented functions--also is fallacious. While it may be valid to say that many activities of government are "process" oriented and therefore do not result in an "end-product" as such, it must be recognized that these processes have (or should have) some objectives which can be analogous to a project completion. Further, a range of cost and time constraints can be associated with most governmental activities. Through effective programming, these activities, in turn, can be organized in an optimal manner so as to minimize activity cost and to utilize the constraints of time more effectively. Assuming that such a program is followed, it will also mean that the time saved through the elimination of inefficiencies will enable the staff to undertake new and varied activities without an increase in size.

The problem of uncertainty, frequently cited as a "justification" for not applying these techniques more widely in the public sector, is a very real problem, however. A program manager or budget analyst seldom is able to predict the exact time duration of any given activity. The time estimate chosen is likely to reflect the most liekly duration, which is the most probable value of an unknown distribution function. If the variance of this distribution is small, the duration may be considered to be approximately deterministic; if the variance is large, however, the duration may be said to be on the verge of being stochastic.[3]

Fortunately, this problem has been dealt with in application with a fair degree of success. As the following case study illustrates, detailed analysis and the use of beta distribution techniques can indicate ways to relax a stochastic situation in order to provide greater validity in time estimates and program schedules.

Summary and Conclusions

Operations are the activities or jobs which must be performed to meet the objectives of a public program. Of vital importance is the sequence or order in which these activities are to be performed. In any program, certain activities can or must be done before others, while some activities can be carried out concurrently with others. In addition to determining the sequence of activities, project managers must establish the method, time, and cost of performing each activity. These factors constitute the basic budget requirements for carrying out public programs. Once a program or project is initiated, management of the activities involves the adherence to some performance schedule. Work programming and operations planning is the determination of requirements for program resources and their necessary order of commitment in the various activities that must be performed to achieve program objectives. Operations control involves the monitoring of these activities to insure that they adhere to an established performance schedule.

The complexities of government and increased demands for more effective utilization of limited public resources give rise to the need for a new breed of public management personnel. This new breed cannot afford to operate on its wits alone as public managers may have been able to do in the past. Like it or not, today's public manager must be willing to understand and use all the management techniques at his or her disposal. A new project cannot be launched, a public facility erected, and in fact, no public program can be initiated successfully unless there is a plan and a schedule of work--one which permits public management to exercise dynamic control throughout the program duration.

CASE STUDY #5: STOCHASTIC TIME DURATIONS AND SCHEDULE RISKS

While assisting in the preparation of the budget request for the Rurbania Department of Parks and Recreation, Goldie Harvstein, a budget analyst in the Department of Planning and Budget, was informed that a park development project would take one year to complete. Ms. Harvstein realized that, if the probability for this time estimate was assumed to have a standard deviation of one month, the time estimate could be off by thirty days either way which would have significant implications for the budget of the Department. Through further discussion with the Parks and Recreation staff, however, she was able to identify twelve related tasks that comprised this parks development project. If each of these tasks had a one-month duration and each had a standard deviation of 2-1/2 days (so that the total deviation remained the same--30 days), Ms. Harvstein reasoned that the standard deviation for the whole project would be only 8.7 days. Ms. Harvstein made this computation by using the following formula:

$$\sqrt{\sum_{i=1}^{12} \sigma_i^2} = \sqrt{12 \times 6.25} = \sqrt{75} = 8.66$$

In other words, uncertainty in time estimates can be reduced by subdividing larger tasks into activities with shorter time durations. The time estimates associated with these shorter tasks are still somewhat stochastic, but to a lesser degree.

Ms. Harvstein concluded that, while she might be able to reduce the standard deviation on this project from one month to 8.7 days, these time estimates were still too approximate to be of much assistance in formulating a project budget. Therefore, she next set out to apply the beta distribution formula to establish a range of confidence in these more detailed time estimates.

The beta distribution formula was formulated by the original PERT development team to deal with the uncertainty of stochastic time estimates and is represented as follows:

$$t_e = \frac{a + 4m + b}{6} = 1/3\ (2m + \frac{a + b}{2})$$

The expected time formula is based on the premise that time durations are unimodal (i.e., only one mode exists--m) and that the variance of the distribution can be estimated as roughly one-sixth of the range. In this case, the range is the difference between the most pessimistic and optimistic time estimates.

The beta distribution formula is applied under the following assumptions:

(1) In most cases, the distribution will be asymmetrical, with the expected value falling between the most likely (mode) and the pessimistic time estimates, resulting in a distribution that is skewed to the left.

(2) The expected value is used in its statistical sense; there is a fifty percent probability that the expected value will be exceeded by the actual duration.

In discussing the project with various staff members in the Department of Parks and Recreation, Goldie Harvstein was able to develop the following table of pessimistic, optimistic, and most likely time estimates for each of the twelve tasks identified previously. Using the beta distribution formula, she was then able to compute expected times (t_e) and standard deviations for each of these tasks, as shown in the last two columns of Table 6-1.

From these calculations, Ms. Harvstein determined that by using the expected times the project could be completed in 360 days, with a standard deviation of 16.35 days. While this was nearly twice that of here original 12 task estimate of 8.7 days, it was significantly lower than the 54.5 days as a standard deviation for the three time estimate totals for the project.

As may be seen from the data in Table 6-1, expected time (t_e) and variance, while statistically related, act somewhat independently in real-world situations. Expected time or expected duration is a statistical term that corresponds to "average" or "mean" in common language. Variance, on the other hand, is a measure of uncertainty; if the variance is large, there is greater uncertainty as to the time at which an activity will be completed. If the variance is small, it follows that the uncertainty will be small. Thus, although the t_e for the third task is less than that of the first task (28 days as compared with 30 days), there is greater uncertainty in the third task, as illustrated by the larger variance ($\sigma^2_{t_e}$).

The variance figures for each activity can be used to develop a probability of completion by some imposed completion date which may serve as an external constraint to any given program or project. The

Table 6-1.--Time Estimates and Standard Deviations for a Parks Development Project--City of Rurbania

Task	Optimistic Time	Most Likely Time	Pessimistic Time	t_e	Standard Deviation
1	20	30	40	30	3.33
2	20	30	58	33	6.33
3	8	30	40	28	5.33
4	18	25	36	26	2.83
5	22	36	45	35	3.83
6	26	38	50	38	4.00
7	12	24	36	24	4.00
8	18	30	48	31	5.00
9	10	28	40	27	6.00
10	12	26	40	26	4.67
11	10	32	42	30	5.33
12	20	31	48	32	4.67
Totals	196	360	523	360	55.32

following procedures are applied:

(1) Use three times estimates for each activity to determine the single applicable value of t_e for that activity.

(2) Calculate the Earliest Possible Occurance (EPO) and Latest Possible Occurance (LPO) for each event and find the critical path.

(3) Using the concept of variance, evaluate the risk or probability of meeting a specific schedule time.

Goldie Harvstein noted that any schedule that require the park development project be completed in less than 360 days would have less than a 50 percent probability of success. This conclusion is based on the assumptions of a beta distribution, whereby the use of t_e values will result in activity completion times that have a 50 percent probability of being met. In other words, by splitting the uncertainty, the manager is taking a 50 percent chance of being right.

By subtracting the earliest time at which all activities can be completed (the EPO) from an imposed schedule completion time, and dividing the results by the standard deviation of the EPO, a value F can be determined. This F value, in turn, can be translated into the probability of success (schedule risk) through the use of a table of values for the normal probability curve. This techniques can be used for the total project EPO or for any event within the project schedule.

The process can also be used in reverse to determine the additional time required to raise the probability of success above the 50 percent level. To illustrate this point, assume that Ms. Harvstein wanted to determine the number of additional days required to increase the probability of success in the park development project schedule to something approaching 90 percent. Consulting a table of values for the normal probability curve, Ms. Harvstein could identify an appropriate F value for several levels of probability over 50 percent. Since the standard deviation for an EPO of 360 days has already been computed as 16.35, she would then merely multiply the F value times the standard deviation to determine the additional days required in the schedule to ensure the desired probability of success (see Table 6-2).

Table 6-2.--Additional Schedule Days Required for Increased Probability of Success

Probability of Success	F Value	σ_E	Additional Days
100%	5.000	16.35	81.75
95%	1.650	16.35	27.00
90%	1.280	16.35	21.00
85%	1.040	16.35	17.00
80%	0.840	16.35	13.75
75%	0.680	16.35	11.00
70%	0.525	16.35	8.60
65%	0.385	16.35	6.30
60%	0.255	16.35	4.15

SCENARIO #5: CRITICAL PATH METHOD

Using the data presented in Table 6-3, the scenario assignment is to calculate expected times (t_e) and standard deviations for each of the seventeen activities, based on the three times estimates provided. Using

Table 6-3.--Optimistic, Most Likely, and Pessimistic Time Estimates for 17 Event Project: Man-Days

Event	Optimistic Time	Most Likely Time	Pessimistic Time	Expected Time	Standard Deviation
A	26	36	70		
B	20	39	64		
C	10	20	60		
D	27	40	83		
E	10	30	50		
F	20	25	30		
G	8	14	26		
H	6	24	48		
I	20	52	72		
J	26	40	54		
K	16	36	50		
L	22	28	46		
M	6	14	28		
N	7	13	31		
O	15	27	57		
P	6	16	20		
Q	13	20	27		
Totals	258	474	816		

this information, the total project duration and the critical path should be identified for the relationships among these activities shown in Figure 6-2. Expected times should be denoted for each activity (arrow leading to a given node), and by tracing the cumulative times for each path in the diagram, the critical path and total project duration should be readily identifiable.

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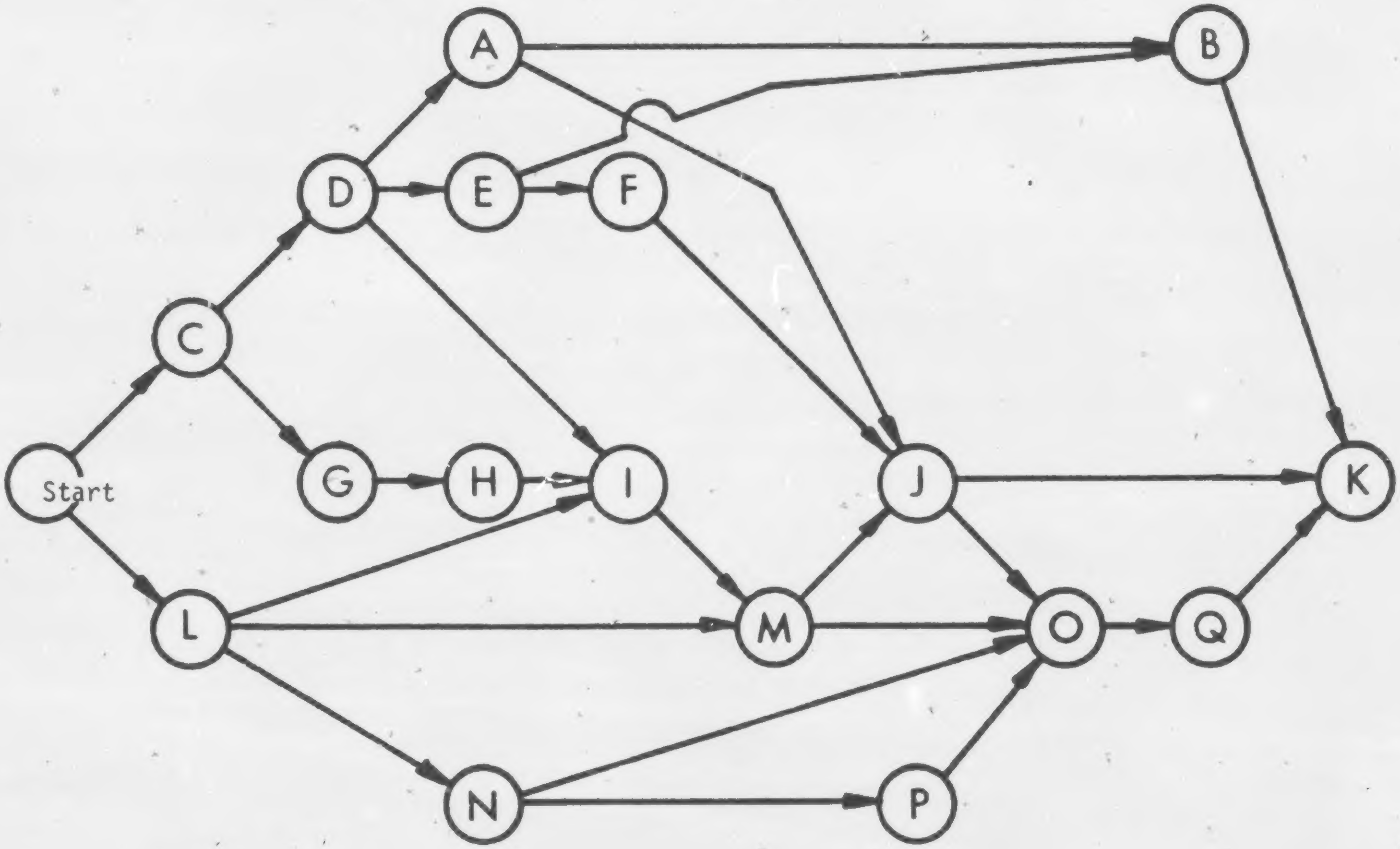

A
B
D
E
F
C
Start
G
H
I
J
K
L
M
O
Q
N
P

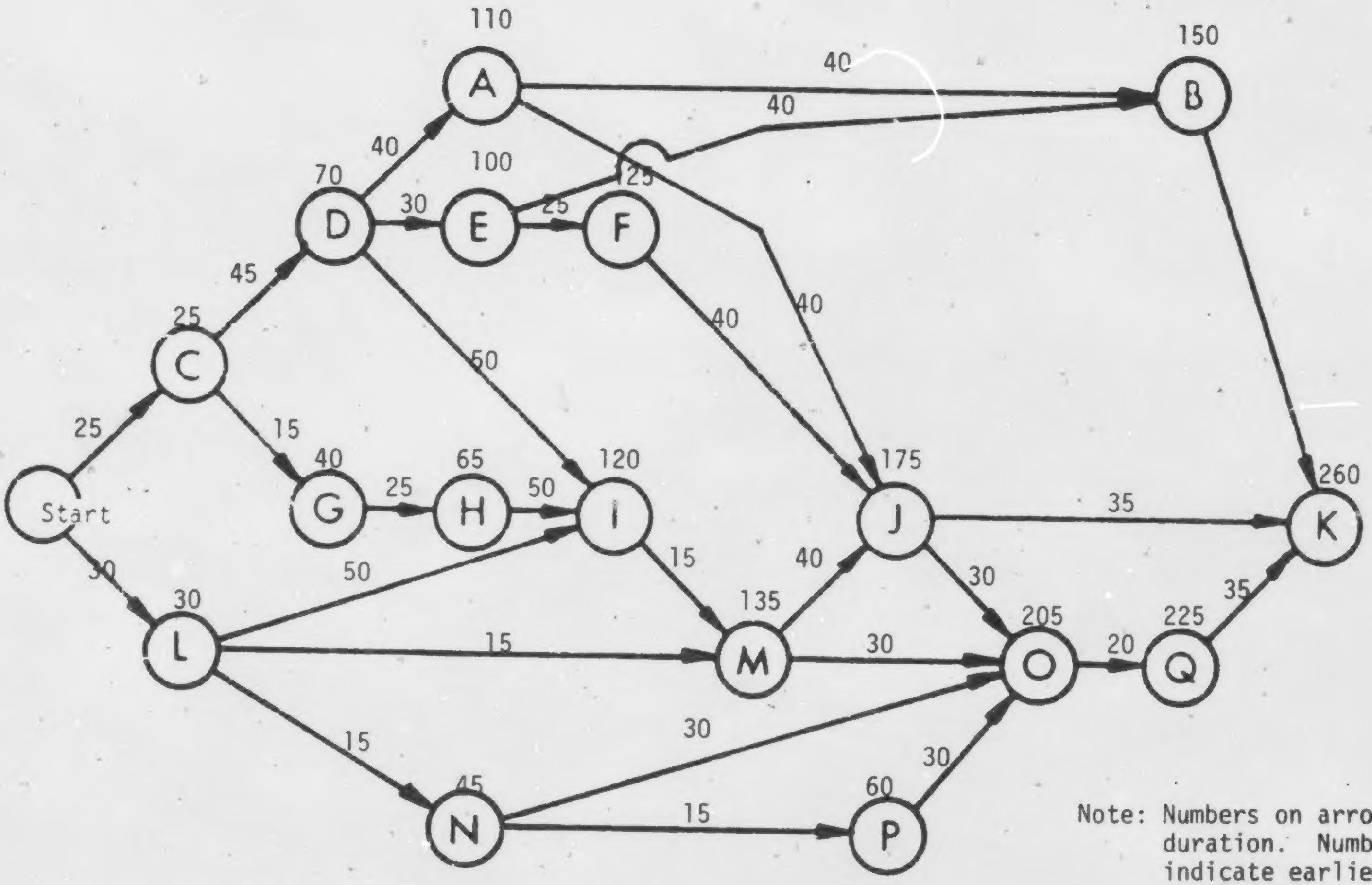
Figure 6-2. Arrow Diagram for Seventeen Event Project.

Table 6-4.--Optimistic, Most Likely, and Pessimistic Time Estimates for 17 Event Project: Man-Days

Event	Optimistic Time	Most Likely Time	Pessimistic Time	Expected Time	Standard Deviation
A	26	36	70	40	7.333
B	20	39	64	40	7.333
C	10	20	60	25	8.333
D	27	40	83	45	9.333
E	10	30	50	30	6.667
F	20	25	30	25	1.667
G	8	14	26	15	3.000
H	6	24	48	25	7.000
I	20	52	72	50	8.667
J	26	40	54	40	4.667
K	16	36	50	35	5.667
L	22	28	46	30	4.000
M	6	14	28	15	3.667
N	7	13	31	15	4.000
O	15	27	57	30	7.000
P	6	16	20	15	2.333
Q	13	20	27	20	2.333
Totals	258	474	816	495	93.000

INSTRUCTIONAL GUIDE #5: CRITICAL PATH METHOD

The appropriate expected time calculations for the data in Table 6-3 are shown in the table above. By assigning these expected times to the appropriate arrows in Figure 6-2, the earliest finish times for each event can be calculated (shown in Figure 6-2a as the number above each node). The total project duration is 260 weeks, with the critical path being events C, D, I, M, J, O, Q, and K.


110
A
150
B
40
40
40
70
D
100
E
125
F
30
25
45
25
C
40
40
50
15
40
G
65
H
120
I
175
J
260
K
Start
25
25
50
35
30
30
L
50
15
135
M
40
30
205
O
20
225
Q
35
15
15
30
45
N
60
P
15
30

Note: Numbers on arrows equal event duration. Numbers on nodes indicate earliest finish time for all events to that node.

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Figure 6-3. Critical Path for Seventeen Event Project (C,D,I,M,J,O,Q,K)

COST-BENEFIT AND COST-EFFECTIVENESS ANALYSIS

Cost-benefit and cost-effectiveness techniques are logical extensions of other management science methodologies, such as the models of operations research and systems analysis. In terms of evaluative scope, however, cost-benefit and cost-effectiveness are more ambitious than most other analytical approaches and, therefore, are more vulnerable to criticism at certain (well-recognized) points. As Prest and Turvey have observed: "One can view cost-benefit analysis as anything from an infallible means of reaching the new Utopia to a waste of resources in attempting to measure the unmeasurable."[4] Techniques of cost-benefit and cost-effectiveness analysis are often misunderstood by the neophyte public official and misapplied by the unscrupulous analyst.

Although some of the criticisms of cost-benefit and cost-effectiveness analysis are based on misconceptions, others are perfectly valid. Many of these valid criticisms, however, are applicable a fortiori to other alternative techniques of budget analysis. All too often, the argument regarding the need to replace relatively poor analysis with better approaches tends to degenerate to assertions that, since analysis is difficult, relatively costly, and often troublesome, it should be abandoned in favor of more intuitive approaches.

Fixed Budget Versus Fixed Benefits

Budget analysis may be undertaken as a preliminary to budget preparation or as a continuing activity to ascertain optimal expenditure patterns. In general, there are two principal approaches to budget analysis: (1) the fixed cost or fixed budget approach, where the objective is to maximize benefits for an established level of costs or predetermined budget allocation; and (2) the fixed benefits approach, where the objective is to ascertain the minimum level of expenditures necessary to achieve some specified level of benefits. While the first approach frequently characterizes the techniques of cost-benefit analysis, the second approach is more closely aligned with the concept of cost-effectiveness analysis, as defined in this presentation.

Very often, a major task in budget analysis centers on a determination of these constraints and may involve a series of iterations in which one component (benefits or budget) is held constant while the other is examined and then modified to more closely approximate the basic program objectives and problem constraints. The process may then be reversed with the fixed component becoming the variable. The objective is to facilitate comparisons among alternatives, and for this purpose, it generally is necessary to hold something constant at each phase of the analysis.

As Maciariello has suggested, the techniques of cost-benefit and cost-effectiveness analysis provide practical tools in the public sector to assist in the selection among alternative expenditures to be made by government in order to carry out its economic role--"a role which includes a requirement that it provide goods and services to remedy what otherwise would be a suboptimal allocation of resources in the economy."[5] The objective of cost-benefit and cost-effectiveness analysis, however, is not to make decisions, nor to justify previous decisions, nor to delay matters so that some prior course of action or commitment of resources has a greater change of continuance.

Objective Function, Constraints, and Externalities

In the traditional formulation of the cost-benefit approach, as first outlined by Otto Eckstein,[6] the allocation (budget) problem is clarified through the identification of: (1) an objective function, (2) constraints, (3) externalities, (4) time dimensions, and (5) risk and uncertainty. Selecting an objective function involves the identification and quantification (in dollar terms, to the extent possible) of the benefits and costs associated with each alternative under consideration. In this way, various alternatives can be compared against each other and against the cost of attaining the desired benefits.

Constraints specify the "rules of the game", i.e., the limitations within which solutions must be sought. Frequently, solutions which are otherwise optimal must be discarded because they violate these imposed rules. Constraints often can be incorporated into mathematical models as parameters or boundary conditions.

Externalities are those factors--inputs (costs), outputs (benefits), and constraints--that initially are excluded from the statement of the problem in order to make it more manageable. Ultimately, the long-range effects of these phenomena must be considered, however. This step is usually undertaken after the objective function or model has been carefully tested and the range of feasible and acceptable alternatives has been narrowed.

In examining the time dimensions of various alternatives, it is necessary to delineate life-cycle costs and benefits. Life-cycle costs can be grouped as follows: (1) research and development--costs associated primarily with the development of new programs or capabilities to the point where they are ready for operational use; (2) investment--costs beyone the "start-up" development phase, frequently in the form of capital construction or capital equipment costs; and (3) operations--recurring costs of operating, supporting, and maintaining a program or capability. Life cycle costing stems from the concept that the funds necessary initially to undertake a program or project should not be the primary consideration, nor should the funds required in any particular time period dominate the decision. Rather, the decision to undertake a particular course of action should take into account the total cost impact over time.

Benefits may also vary widely over the life of a project or program. There may be a time lag between the initiation of a project and the realization of the first increment of benefits. Benefits may build gradually or may accumulate rapidly; they may reach a peak and decline rapidly or may taper off slowly. In short, the timing of costs and benefits cannot be ignored. It is not sufficient to merely add the total benefits and subtract the total costs that are estimated for a given project or alternative. Rather, it is necessary to consider the "stream" or pattern of benefits and costs over time and to calculate a measure that can reflect the impact of deferred benefits or future costs.

Present Value and Discounting

Benefits that accrue in the present are "worth" more to their recipients than benefits that occur some time in the future. Similarly, funds that must be invested today "cost more" than funds that must be invested in the future, since presumably one alternative use of such funds would be to invest them at some rate of return that would increase their value. Therefore, it is necessary to calculate the present value of both costs and benefits by multiplying each stream by an appropriate discount factor. This factor gets smaller as the costs or benefits occur farther in the future. If the alternative is to invest available funds at some interest rate (i), then an appropriate discount factor can be expressed as:

$$\frac{1}{(1 + i)^n} \text{ or } (1 + i)^{-n}$$

where (i) is the relevant interest rate per period, and (n) is the number of periods into the future that the benefits or costs will accrue. A high discount rate means that the present is valued considerably over the future; that is, there is considerable time preference, a higher regard for present benefits than for equal future benefits, and/or a willingness to trade some amount of future benefits for current benefits. Two reasons exist for discounting public projects: (1) to reflect a social preference for earlier over later benefits; and (2) to reflect opportunity costs of public investments, e.g., the cost of investing in project A now over investing in project B at some time in the future.

Benefit/Cost Ratio

The benefit/cost ratio is defined as the present value of the benefits divided by the present value of the costs (or average annual benefits over average annual costs), which can be expressed mathematically as follows:

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$$R = \frac{\sum_{n=0}^{N} B_n (1 + i)^{-n}}{\sum_{n=0}^{N} C_n (1 + i)^{-n}} = \frac{B}{C}$$

Thus, if the discounted stream of benefits over the life of the project equals $400,000 and the discounted stream of costs equals $320,000, the benefit/cost ratio is 1.25.

Net Benefits

Net beneftis is the criterion recommended, if not used, most frequently in contemporary cost-benefit analysis. The formula for calculating the present value of net benefits is:

$$n = -C_0 + \frac{(B_1 - C_1)}{(1 + i)} + \frac{(B_2 - C_2)}{(1 + i)^2} + \ldots + \frac{(B_n - C_n)}{(1 + i)^n}$$

Two projects of equal net benefits might not be regarded indifferently, however. Suppose two projects offered net benefits of $1,000, but one involved a present value of benefits of $2 million and a present value of costs of $1.999 million, while the other had a present value of benefits of $10,000 and a present value of costs of $9,000. Suppose that something went wrong--perhaps the calculations of costs and benefits were off by ten percent; the first project might have negative net benefits of as much as $200,000, whereas the second would do no worse than break even.

A Comparison of Basic Cost-Benefit Criteria

It is sometimes assumed that an alternative that ranks first in terms of net benefits will also rank first in terms of its benefit-cost ratio--that these techniques are readily interchangible. The fact that the net present value of alternative A is greater than the net present value of alternative B does not imply that the benefit-cost ratio of alternative A is greater than the benefit-cost ratio of alternative B--net present value (net benefits) measures difference, whereas benefit-cost calculations produce a ratio.

To illustrate this point, suppose the benefits in alternative A have a present value of $150,000 and costs have a present value of $50,000. The net present value of alternative A would be $100,000 and the benefit-cost ratio $150,000/$50,000 or 3.0. In alternative B, let the present value of benefits be $100,000 and that of costs $20,000. Alternative B has a smaller net present value ($80,000), but a higher benefit-cost ratio ($100,000/$20,000 or 5.0). Knowing the benefit-cost ratio for a given alternative or project is not sufficient; it is also necessary to know the size of the project before as much information is available as is given in the present value of net benefits.

A central problem in cost-benefit analysis is the treatment of certain items which may be considered either as *benefits* or as *cost savings*. In dealing with this question, the net benefits criterion is superior to the benefit-cost ratio method. To illustrate this point, suppose that a public project is estimated to cost $100,000 and have measureable benefits of $120,000 (all figures in present value terms). In addition, it is estimated that this project will increase land values in some parts of the community by $40,000, while decreasing other land values by $20,000 (the project might involve the construction of a sewage treatment facility, the increased service of which would increase some land values, while proximity to the facility might lead to the decrease of other land values). If it could be determined that these land value changes were not simply capitalization of otherwise measured benefits and costs (so that including them would result in double counting), it would be appropriate to incorporate them in the cost-benefit analysis.

How to treat these additional factors, however, remains the problem. Land value increases could be included as benefits, while decreases in land values could be considered as a cost, resulting in a benefit/cost ratio of 1.33. Or the net change in land values (i.e., $40,000 - $20,000) could be included as benefits (resulting in a ratio of 1.4) or as "cost savings" (yielding a ratio of 1.5). In considering several alternative investments, elaborate accounting rules and procedures must be devised to keep the analyses comparable. As long as the algebraic sign and the time period in which benefits and costs accrue are known, such ambiguity does not exist in the application of the net benefits criterion.

Output Orientation of Cost-Effectiveness Analysis

Significant criteria and controls employed in the budgetary process traditionally have been of a financial nature, focusing on the expenditure of money (a fixed budget approach). Under such conditions, public decision-making frequently becomes *input-oriented*, i.e., the analysis of objectives and alternative methods of achieving these objectives is based on money-related rather than policy-related iddurd. If there are sufficient funds to pay for the "inputs"--the resources requested by the various agencies--there is no major budget problem in government. Seldom are projections or estimates made of the *effectiveness* of these inputs in terms of meeting public needs and demands or the performance of public services. As a consequence, there is no guarantee that the public decision process will be responsive to comprehensive objectives.

Traditional decision-making and analytical mechanisms (including cost-benefit analysis in many forms of application) are designed to pursue efficiency, often at the expense of effectiveness. This characteristic of public decision-making can be observed in the continual emphasis on the achievement of economies without decreasing service, i.e., the focus is on the elimination of waste. Questions of efficiency generally are defined and answered strictly in economic terms, with minimum consideration given to priorities and/or the relative worth of the programs pursued. By pretending that technical analyses--analyses that focus on efficiency--are sufficient for political decisions, decision-makers often lose the very information necessary to determine effectiveness. Thus, there is critical need for new techniques for optimizing the allocation of public resources. One such technique that holds considerable promise in this connection is cost-effectiveness analysis.

Cost-effectiveness is a form of "cost-utility" analysis in which alternative courses of action are compared in terms of two consequences associated with each alternative: (1) dollar or resource costs and (2) effectiveness. The preferred alternative is usually taken to be either the one that produces the maximum effectiveness for a given level of cost or the minimum cost for a fixed level of effectiveness. The effectiveness of an alternative is measured by the extent to which that alternative, if implemented, will attain the desired objective(s). While costs can ordinarily be represented in monetary terms, objectives usually are expressed by nonpecuniary indices (effectiveness measures).

A basic modus operandi of cost-effectiveness analysis involves the identification and analysis of alternative "systems" to achieve some agreed-upon end objectives. In program budgeting, the selected system often becomes a program element--an integrated set of activities that combines personnel, services, equipment, and facilities. The cost of a system should reflect the total resource impact of the decision relating to that system, identifying the magnitude of all relevant costs necessary to achieve a particular alternative course of action.

In cost-effectiveness analysis, it is assumed that normative statements of performance (goals) can be derived, or inferred, from current conditions. Thus, current operations and their effects must be under continuous surveillance, i.e., continuous program evaluation is the most effective means available for initiating a goal-oriented budget-making system in an existing governmental structure. In this manner, goals are defined by: (1) establishing current levels and types of performance in each discrete program category; (2) estimating the current impacts of public resources on that performance; and (3) defining desired levels and types of performance. The development of positive statements of performance provides a base from which to define and evaluate change.

Effectiveness measures--indicators that measure the direct and indirect impacts of public resource allocations--must be developed and applied to determine the level of goal achievement. These measures involve a basic scoring technique for determining the state of a given system at any point in time. In the evaluation of alternatives, it is desirable to array effectiveness measures along an effectiveness scale to indicate the degree of goal achievement evidenced by each of the alternatives.[8]

In cost-effectiveness analysis a cost curve is developed for each alternative, representing the sensitivity of costs (inputs) to changes in the desired level of effectiveness (outputs). Unless these cost relationships are understood, it is not possible to know what would happen as the desired level of effectiveness-the goal--is raised or lowered. Costs may change more or less proportionately. However, if effectiveness increases more rapidly than costs, then the particular alternative is operating at a level of increasing returns (represented by a positively sloped curve accelerating at an accelerating rate, as illustrated by the initial segment of cost curve A in Figure 6-4). If costs increasemore rapidly than effectiveness, the alternative is operating in an area of diminishing returns. Increasing returns do not mean that an alternative should be automatically adopted (or if an ongoing program, expanded). Conversely, diminishing returns should not automatically disqualify a program alternative. It is useful to know, however, that an additional commitment of, for example, $200,000 to one alternative will carry it 20 percent closer toward an established goal, whereas the same resources added to another alternative will carry it only five percent closer.

Cost-effectiveness analysis requires the construction of a model that can relate incremental costs to increments in effectiveness. For some types of problems, practical models may be developed with relative ease; for other problems, cost curves can be approximated from historical data. Construction of cost curves should become increasingly more sophisticated as the input-output relationships associated with the various alternatives are better understood.

Given that the cost and effectiveness of each alternative can be determined separately and for different levels of input-output relationships, the problem is still how to choose among these alternatives. In principle, the criterion or rule of choice to be applied is to select that alternative which yields the greatest excess of positive impacts (attainment of objectives) over negative impacts (resources used, or costs and externalities, or "spillovers" that reduce effectiveness). In practice, however, this ideal criterion seldom is applied, since there is no practical way of subtracting dollars spent from the nonmonetary measures used to identify effectiveness.

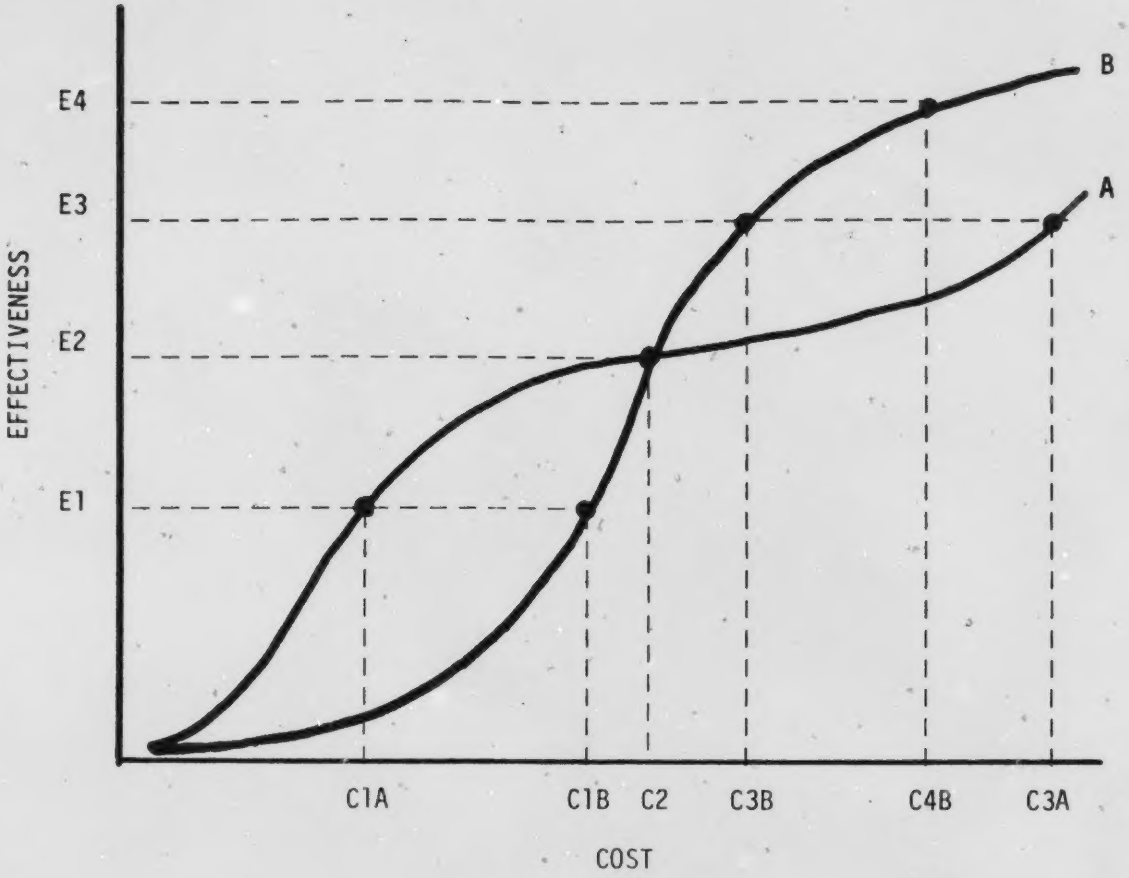

Figure 6-4. Cost-Effectiveness Comparison

Therefore, a cost-effectiveness comparison of alternative must be undertaken, as shown graphically in Figure 6-4. Alternative A achieves the first level of effectiveness (E1) with a relatively modest level of cost (CIA), whereas twice the level of resources (C1B) would be required to achieve the same level of effectiveness using alternative B. Both alternatives achieve the second level of effectiveness (E2) at the same level of cost (C2). Alternative B requires less resources (3B) to achieve the third level of effectiveness. And only alternative B achieves the fourth level of effectiveness; the program cost curve of alternative A is not projected to reach this level of effectiveness.

Which of these two alternatives is more desirable? To answer this question, it is necessary to define the optimum envelope formed by these two cost curves. If resources in excess of C2 are available, alternative B clearly provides the better choice; however, if resources less than C2 are available, alternative A provides the greater effectiveness for the dollars expended. In general, it is not possible to choose between two alternatives just on the basis of cost and effectiveness (unless one alternative dominates at all levels of effectiveness). Usually, either a desirable level of effectiveness must be specified and then costs minimized for that effectiveness, or a cost limit must be specified, and effectiveness maximized.

Incremental Costing

In cost-effectiveness analysis, the cost analysis phase can be viewed as an application of the economic concept of marginal analysis. The analysis must always move from some base that represents existing capabilities (the present state of the system) and the existing resource base. The problem is to determine how much additional resources will be required to achieve some specified additional performance capability (the desired state of the system), or conversely, how much additional performance capability would result from some additional expenditure. Therefore, incremental costs are the most relevant factors in cost analysis. The economic concept of marginal analysis must be distinguished from the accounting concept of associating total costs, including an allocated share of indirect expense, to an end item. Ideally, the incremental cost of a system is the difference between two programs, one with the improved system and one without it.

In measuring incremental costs, care must be taken to exclude sunk costs. Sunk costs or costs which have been expended in the past are not relevant to the question: "What will it cost in the future to acquire a future performance capability?" No matter how "unfair" it may seem, past costs should not be included in the analysis regardless of how much money may be involved. This is not to say that the resources acquired by past expenditures should be excluded from the analysis, however. Should sunk costs result in inheritable assets (i.e., resources that will become available only to the system under analysis), the sunk costs of those assets should be excluded. Inheritable assets can result from sunk costs on many systems, not just the ones under obvious consideration. It is for this reason that explicitly costing a total program is best, because all systems can be examined and a more accurate picture of resources available for other systems can be revealed. Conversely, all the systems competing for these assets are revealed and thus, a more realistic picture of net asset requirements can be shown.

Summary and Conclusions

The techniques of cost-effectiveness analysis are relatively new, having their origins in the early sixties, and consequently have not yet reached full maturity. Initially, cost-effectiveness analysis was developed for application when benefits could not be measured in units commensurable with costs. In these early cost-effectiveness analyses, the output or level of effectiveness was usually taken as a given, and several methods of achieving this level were examined in the hope that one would have lower costs than others. These initial explorations revealed many important aspects of public decisions regarding the allocation of scarce resources.

Cost-effectiveness analysis provides an output-oriented focus for the evaluation of program alternatives. It places particular emphasis on goals (the fixed benefits approach) and the application of effectiveness measures. The extended time horizon adopted in cost-effectiveness analysis leads to a fuller recognition of the need for life-cycle costing and benefits analysis and the importance of incremental costing, sunk cost, and inheritable assets.

As with the other analytical techniques, the cost-effectiveness model need not be adopted "whole cloth." A number of sub-routines of this approach may be introduced into on-going procedures of budget analysis. Of particular importance would be considerations developed through the more narrowly defined technique of cost-effectiveness curve analysis. As the complexity of the resource allocation problem becomes more evident, other sub-routines then may be adopted, depending upon the availability of data and the needs and capabilities of budget analysis.

CASE STUDY #6: COST-BENEFIT/EFFECTIVENESS ANALYSIS

This case study/scenario examines the potential impact of various educational programs to alleviate the problem of high school dropouts in the seventh through twelfth grades. It is adapted from an actual case study conducted in the City of Los Angeles, as reported by Werner Z. Hirsch, Morton J. Marcus, and Robert M. Gay in Program Budgeting for Primary and Secondary Public Education (New York: Praeger Publishers, 1972). The data presented herein have been modified to fit the scenario format and conditions appropriate to the City of Rurbania. The procedures outlined, however, parallel to those followed in the Los Angeles study.

Characteristics of Potential Drop-Outs

Experience and empirical information suggest that students with a high tendency to drop out of secondary school have specific kinds of characteristics. Therefore, the number of students from any given grade who are potential dropouts can be identified. In large part, the effectiveness of the schools in retaining students will depend on the extent to which school-related causes of leaving are mitigated and the extent to which the schools can reach the students and their families to encourage and assist in their continuance in the education system. Knowledge of the factors associated with leaving school is growing rapidly, but effective efforts to decrease the dropout rate remain somewhat limited.

The academic, psychological, and sociological effects of failures in early school years seem to be of great important in latter dropping out. Statistical evidence suggests that early identification is possible, perhaps in the second grade, by which time 50 percent of those who eventually do poorly in high school have already experienced academic failures. By the seventh grade, potential dropouts are identifiable from their test scores and class performance. At this point, the student has moved into the junior high school--a new environment and an important stage in personal development.

The impact of dropping out of school is significant in terms of the lifetime earning capacity of the student who leaves school before completing his or her secondary education. Studies show that the present value of the incremental income associated with a high school education over an eighth grade education (discounted at 5 percent, with no allowance for productivity increases) is $20,000 for males at age 18. Even at a more conservative level of $10,000 in present value terms, the 240 students that drop out of the Rurbania schools each year represent a $2.4 million loss in life-time earning power.

Three Alternative Approaches

Dr. Ophelia Goodmind, Assistant Superintendent of Schools for the City of Rurbania, identified three alternative approaches to deal with the problems of school dropouts, based on experimental programs developed in other major cities. Each of these approaches has a different projected level of effectiveness based on inherent characteristics of the selected programs. Each approach also has a different cost curve stemming from the staffing configuration and supporting costs.

The first program alternative, if fully implemented, is projected to have a 100 percent level of effectiveness in eliminating dropouts through an intensive use of counselors and supplementary teachers assigned to work with the target groups. It is assumed that these counselors and supplementary teachers will receive premium salaries and have available to them materials and facilities of very high caliber, including regularly monitored, computerized information on student performance. Additional career-oriented vocational courses and supporting facilities are included in this alternative.

The second program alternative is projected to have up to a 75 percent level of effectiveness. While many of the same program elements incorporated in the first program alternative are also envisioned here, the intensity of special personnel is reduced and greater reliance is placed on the use of regular teachers to carry out the program objectives.

The third program makes extensive use of machine-learning techniques (is more capital intensive) and depends more on self-selection and self-motivation, following an initial period of counselling. As a consequence, this third alternative is projected to have a maximum level of effectiveness of only 60 percent.

One of the by-products of such programs is that, as a consequence of reducing the dropout rate, there are more students in the school system. Therefore, the schools must assume additional expenditures for regular instructional services to the increased enrollment and must provide additional support personnel.

Dr. Goodmind calculated the personnel needs of each of these three alternatives if applied to the Rurbania secondary school system as shown in Table 6-6. From this tabular summary, it may be seen that the first alternative requires one counselor for every 20 students in the target population, whereas Alternative II uses one for every 25, and Alternative III, one for every 30. Supplementary teachers enter the program in the second year, and a base number is required regardless of the number of students in the target population. Alternatives II and III place more reliance on regular teachers than does alternative I. The ratio between support personnel and instructional personnel is the same in Alternatives I and II but only half as great in the case of Alternative III. Alternative III, as suggested previously, is more capital intensive, with one dollar in support funding required for every $3.00 in salaries.

As is often the case in such analyses, the actual target population of these program alternatives is an unknown. This problem can be reconciled, however, by assuming a hypothetical population and tracing its progression through an academic cycle, as shown in Table 6-7. In this application, a 10,000-student cohort is traced over seven years,

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with the effective dropout and failure rates given at the far right of the table. It is assumed that a second failure is equivalent to dropping out. Without an additional program designed to reduce the number of students leaving school, 2,823 students (or 28.23 percent of the original population) will drop out in the seven years that it takes this cohort to more through the system.

TABLE 6-6. Ratios Between Special and Regular Instruction and Support Personnel and Additional Students in School as a Consequence of Reduced Drop-Out Rates.

Personnel Category	Alternatives		
	I	II	III
Counselors	1 : 20	1 : 25	1 : 30
Supplementary Teachers	5 plus 1 : 20	3 plus 1 : 15	3 plus 1 : 20
Regular Teachers	3 : 100	1 : 25	1 : 30
Ratio of Support to Instructional Personnel	1 : 5	1 : 5	1 : 10
Ratio of Support Dollars to Salary Dollars	1 : 6	1 : 5	1 : 3

On the basis of these calculations, Dr. Goodmind reasoned that, if dropouts were reduced to zero in the Rurbania school system (the projected effectiveness of the first alternative), all of the 1,500 students currently in the seventh grade would graduate by the end of the seventh year, as compared to 1,076 graduates when dropouts occur. At a 75 percent level of effectiveness, 318 of the potential 424 dropouts would graduate by the seventh year, while at the 60 percent level of effectiveness (alternative III), 254 potential dropouts would continue through to graduation.

Dr. Goodmind next set out to develop cost estimates for each of the three dropout prevention efforts. Using the data for the hypothetical population (Table 6-7), Dr. Goodmind calculated appropriate ratios to trace a population of 1,500 students through the seven years of the program yielding a 100 percent level of effectiveness, as shown in Table 6-9 (output selection). Using the staff-student ratios from Table 6-6, Dr. Goodmind was able to calculate the number of instructional and support staff required in each of the seven years (input section). The final step in completing this initial cost analysis involved the multiplication of personnel positions times salaries (using average salary figures shown in Table 6-8), a summation of each year's personnel costs,

TABLE 6-7.

Academic Progression of 10,000 Students Entering Seventh Grade, with Existing Dropout- and Failure-Prevention Efforts

Fiscal Year	Grade	Students Entering	Dropouts	Failures	Graduates	d_t^i	f_t^i
1	7	10,000	100	400	9,500	.01	.04
2	7	400	20	←	380	.01	.04
	8	9,500	190	380	8,930	.02	.04
3	8	760	46	←	714	.02	.04
	9	8,930	447	357	8,126	.05	.04
4	9	1,071	96	←	975	.05	.04
	10	8,126	569	325	7,232	.07	.04
5	10	1,300	143	←	1,157	.07	.04
	11	7,232	651	289	6,292	.09	.04
6	11	1,446	188	←	1,258	.09	.04
	12	6,292	252	252	5,788	.04	.04
7	12	1,510	121	←	1,389	.04	.04

Students graduating high school	7,177
At grade	(5,788)
Below grade	(1,389)
Dropouts	2,823
TOTAL	10,000

and a calculation of support costs in accordance with the established ratio (all figures rounded to whole dollars). Dr. Goodmind rounded all staffing calculations to a full or half-time position.

As shown in Table 6-9, the first alternative (100 percent effectiveness) would cost $3,510,500 to complete the full seven year cycle. Alternative II (75 percent effectiveness) would require a commitment of $2,844,600 over the seven year period, suggesting that this program alternative would be somewhat more costly for the level of effectiveness achieved. Alternative III (60 percent effectiveness) would cost $1,981,334, or approximately 56 percent the cost of Alternative I.

TABLE 6-8. Dropout Prevention Programs: Annual Input Costs

Counselor	$15,000
Supplementary Teacher	$13,000
Regular Teachers	$12,000
Support Personnel (average)	$10,000
Costs for Materials, Facilities, and Other Expenses	See Table 6-6

Using as cost per dropout prevented as an indice of cost-effectiveness, Dr. Goodmind next calculated cost-effectiveness ratios for each of the three alternatives as follows:

Alternative I : $\frac{\$3,510,500}{424} = \$8,279.48$

Alternative II : $\frac{\$2,844,600}{318} = \$8,945.28$

Alternative III: $\frac{\$2,016,000}{254} = \$7,937.00$

Based on these calculations, it may be concluded that Alternative III is considerable more cost-effective than either I or II, with Alternative I ranking second, and Alternative II a poor third.

Dr. Goodmind decided that it would be useful to develop cost-benefit comparisons among the three alternatives. At the outset of the case study, it was suggested that the present value of the incremental income associated with a high school education over an eighth grade education (discounted at five percent) is $20,000. This estimate is calculated by taking the annual average salary of an individual in the years between 18 and 65, with and without a high school education, and subtracting the second from the first. The resulting differentials in earning capacity are then discounted to present value (using 0.05 in the discount formula shown below):

$$\frac{\$}{(1 + i)^n}$$

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TABLE 6-9. Drop-Out Prevention Program, Cohort Basis: Alternative I

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	306	118
Dropouts Prevented	15	32	74	100	119	66	18
Additional Students	0	15	47	121	221	340	100
In School	15	47	121	221	340	406	118
II. Input Section							
Counselors	1.0	2.5	6.0	11.0	17.0	20.5	6.0
Supplementary Teachers	0.0	7.5	11.0	16.0	22.0	25.5	11.0
Regular Teachers	0.5	1.5	3.5	6.5	10.0	12.0	3.5
Total Instructional Personnel	1.5	11.5	20.5	33.5	49.0	58.0	20.5
Support Personnel	0.5	2.5	4.0	6.5	10.0	11.5	4.0
III. Costs							
Counselors	$ 15,000	$ 37,500	$ 90,000	$ 165,000	$ 255,000	$ 307,500	$ 90,000
Supplementary Teachers	0	97,500	143,000	208,000	286,000	331,500	143,000
Regular Teachers	6,000	18,000	42,000	78,000	120,000	144,000	42,000
Support Personnel	5,000	25,000	40,000	65,000	100,000	115,000	40,000
Total Salaries	$ 26,000	$ 178,000	$ 315,000	$ 516,000	$ 761,000	$ 898,000	$ 315,000
Support Costs	4,333	29,667	52,500	86,000	126,833	149,667	52,500
Fiscal Year Totals	$ 30,333	$ 207,667	$ 367,500	$ 602,000	$ 887,833	$1,047,667	$ 367,500
Grand Total							$3,510,500

TABLE 6-10. Drop-Out Prevention Program, Cohort Basis: Alternative II

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	229	89
Dropouts Prevented	11	24	56	75	89	50	13
Additional Students	0	11	35	91	166	255	76
In School	11	35	91	166	255	305	89
II. Input Section							
Counselors	0.5	1.5	3.5	6.5	10.0	12.0	3.5
Supplementary Teachers	0	5.5	9.0	14.0	20.0	23.5	9.0
Regular Teachers	0.5	1.5	3.5	6.5	10.0	12.0	3.5
Total Instructional Personnel	1.0	8.5	16.0	27.0	40.0	47.0	16.0
Support Personnel	0	1.5	3.0	5.5	8.0	9.5	3.0
III. Costs							
Counselors	$ 7,500	$ 22,500	$ 52,500	$ 97,500	$ 150,000	$ 180,000	$ 52,500
Supplementary Teachers	0	71,500	117,000	182,000	260,000	305,500	117,000
Regular Teachers	6,000	18,000	42,000	78,000	120,000	144,000	42,000
Support Personnel	0	15,000	30,000	55,000	80,000	95,000	30,000
Total Salaries	$ 13,500	$ 127,000	$ 241,500	$ 412,500	$ 610,000	$ 724,500	$ 241,500
Support Costs	2,700	25,400	48,300	82,500	122,000	144,900	48,300
Fiscal Year Totals	$ 16,200	$ 152,400	$ 289,800	$ 495,000	$ 732,000	$ 869,400	$ 289,800
Grand Total							$2,844,600

TABLE 6-11. Drop-Out Prevention Program, Cohort Basis: Alternative III

	Fiscal Year						
	1	2	3	4	5	6	7
I. **Output Section**							
Students Graduated	0	0	0	0	0	183	71
Dropouts Prevented	9	19	44	60	71	40	11
Additional Students	0	9	28	72	132	203	60
In School	9	28	72	132	203	243	71
II. **Input Section**							
Counselors	0.5	1.0	2.5	4.5	7.0	8.0	2.5
Supplementary Teachers	0	4.5	6.5	9.5	13.0	15.0	6.5
Regular Teachers	0.5	1.0	2.5	4.5	7.0	8.0	2.5
Total Instructional Personnel	1.0	6.5	11.5	16.5	27.0	31.0	11.5
Support Personnel	0	0.5	1.0	1.5	2.5	3.0	1.0
III. **Costs**							
Counselors	$ 7,500	$ 15,000	$ 37,500	$ 67,500	$ 105,000	$ 120,000	$ 37,500
Supplementary Teachers	0	58,500	84,500	123,500	169,000	195,000	84,500
Regular Teachers	6,000	12,000	30,000	54,000	84,000	96,000	30,000
Support Personnel	0	5,000	10,000	15,000	25,000	30,000	10,000
Total Salaries	$ 13,500	$ 90,500	$ 162,000	$ 260,000	$ 383,000	$ 441,000	$ 162,000
Support Costs	4,500	30,167	54,000	86,666	127,667	147,000	54,000
Fiscal Year Totals	$ 18,000	$ 120,667	$ 216,000	$ 346,666	$ 510,667	$ 588,000	$ 216,000
Grand Total							$2,016,000

To develop comparable cost data, Dr. Goodmind discounted to present value the projected program expenditures for each of the three alternatives, as shown in the following tables.

TABLE 6-12. Present Value of Program Costs: Alternative I.

Year	Annual Program Costs	Discount Factor	Present Value of Annual Program Costs
1	$ 30,333	0.95238	$ 28,889
2	207,667	0.90703	188,360
3	367,500	0.86384	317,461
4	602,000	0.82270	495,265
5	887,833	0.78353	695,644
6	1,047,667	0.74622	781,790
7	367,500	0.71068	261,175
Totals	$3,510,500		$2,768,584

Benefit/Cost Ratio = ($20,000 x 424) ÷ $2,768,584 = 3.063

Net Benefits = $8,480,000 - $2,768,584 = $5,711,416

TABLE 6-13. Present Value of Program Costs: Alternative II.

Year	Annual Program Costs	Discount Factor	Present Value of Annual Program Costs
1	$ 16,200	0.95238	$ 15,429
2	152,400	0.90703	138,231
3	289,800	0.86384	250,341
4	495,000	0.82270	407,237
5	732,000	0.78353	573,544
6	869,400	0.74622	648,764
7	289,800	0.71068	20 205,955
Totals	$2,844,600		$2,239,501

Benefit/Cost Ratio = ($20,000 x 318) ÷ $2,239,501 = 2.840

Net Benefits = $6,360,000 - $2,239,501 = $4,120,499

TABLE 6-14. Present Value of Program Costs: Alternative III.

Year	Annual Program Costs	Discount Factor	Present Value of Annual Program Costs
1	$ 18,000	0.95238	$ 17,143
2	120,667	0.90703	109,449
3	216,000	0.86384	186,589
4	346,666	0.82270	285,202
5	510,667	0.78353	400,123
6	588,000	0.74622	438,777
7	216,000	0.71068	153,507
Totals	$2,016,000		$1,590,790

Benefit/Cost Ratio = ($20,000 x 254) ÷ $1,590,790 = 3.193

Net Benefits = $5,080,000 - $1,590,790 - $3,489,210

As these cost-benefit calculations show, Alternative III yields the best benefit/cost ratio, whereas Alternative I provides the largest net benefits (due to its higher level of effectiveness). Dr. Goodmind's initial recommendations were to set aside Alternative II from further consideration (since it ranked third in terms of the cost-effectiveness ratio and the benefit-cost ratio). Should there be no budget constraints on this program, she recommended that Alternative I be implemented since it provided the largest net benefits. Should the funds available to this program be limited to approximately $2,000,000 for each cycle, however, she recommended that Alternative III be implemented.

Dr. Goodmind made one further set of calculations in support of her recommendations. Anticipating a question likely to be raised by the School Board, she determined the cost of a 60 percent effective program using the staffing and support characteristics of Alternative I. As shown in Table 6-15, using the approach of Alternative I but seeking to reach only 60 percent of the potential dropouts would cost $2,290,751, for a cost-effectiveness ratio of $9,018.70 per dropout prevented. In other words, using Alternative I to achieve a 60 percent level of effectiveness would cost approximately $274,751 more than Alternative III (or $1,081.70 per dropout prevented).

SCENARIO #6: OPPORTUNITY COSTS AND COMBINED SOLUTIONS

Given the "logic" of Dr. Goodmind's analysis, there was strong sentiment among members of the Rurbania School Board to adopt the third program alternative, since it was argued that there was no guarantee of 100 percent effectiveness if Alternative I was implemented and further, that Alternative III provided the best cost-effectiveness and benefit-cost ratios (the "most bang for the buck"). Some members of the Board also argued that dropping out, in effect, was a "necessary evil" of our economic system in that someone has to fill the low income, unskilled jobs in our society.

TABLE 6-15. Drop-Out Prevention Program: Alternative I at a 60 Percent Level of Effectiveness

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	183	71
Dropouts Prevented	9	19	44	60	71	40	11
Additional Students	0	9	28	72	132	203	60
In School	9	28	72	132	203	243	71
II. Input Section							
Counselors	0.5	1.5	3.5	6.5	10.0	12.0	3.5
Supplementary Teachers	0.0	6.5	8.5	11.5	15.0	17.0	8.5
Regular Teachers	0.0	1.0	2.0	4.0	6.0	7.5	2.0
Total Instructional Personnel	0.5	9.0	14.0	22.0	31.0	36.5	14.0
Support Personnel	0.0	2.0	3.0	4.5	6.0	7.5	3.0
III. Costs							
Counselors	$ 7,500	$ 22,500	$ 52,500	$ 97,500	$ 150,000	$ 180,000	$ 52,500
Supplementary Teachers	0	84,500	110,500	149,500	195,000	221,000	110,500
Regular Teachers	0	12,000	24,000	48,000	72,000	90,000	24,000
Support Personnel	0	20,000	30,000	45,000	60,000	75,000	30,000
Total Salaries	$ 7,500	$ 139,000	$ 217,000	$ 340,000	$ 477,000	$ 566,000	$ 217,000
Support Costs	1,250	23,167	36,167	56,667	79,500	94,333	36,167
Fiscal Year Totals	$ 8,750	$ 162,167	$ 253,167	$ 396,667	$ 556,500	$ 660,333	$ 253,167
Grand Total							$2,290,751

Mr. P.E. Dagogy, a member of the School Board, challenged this economic deterministic "justification" for abandoning efforts to seek greater effectiveness in such programs. He pointed out that the focus of such dropout prevention programs could be on vocational training--on providing specific skills that would assist the student in securing a job upon graduation. Mr. P.E. Dagogy suggested that a more appropriate question might be: What are the "opportunity costs" associated with a less than fully effective program? He pointed out that Alternative II prevents 106 fewer dropouts than Alternative I, while Alternative III prevents 170 fewer dropouts than Alternative I. Using the $20,000 (the discounted value of differential earning power) as a measure of opportunity cost (or benefits foregone), these differences in dropouts prevents translated into $2,120,000 and $3,400,000 respectively. The cost difference among these three alternatives in present value terms is as follows:

I vs. II: $2,768,584 minus $2,239,501 = $ 529,083

I vs. III: $2,768,584 minus $1,590,790 = $1,177,794

The "net benefits foregone" by a less than fully effective program are $1,590,917 in the case of Alternative II and $2,222,206 for Alternative III.

Mr. Dagogy pointed out that this figures out to be $15,009 per dropout not prevented in the case of Alternative II, which is higher than the average net benefits per dropout prevented associated with this alternative (i.e., $4,120,499 divided by 318 = $12,958). Therefore, operating Alternative I at or above the 75 percent level of effectiveness provides a better "marginal return" than can be obtained through Alternative II.

Dr. Goodmind was quick to note, however, that she had abandoned Alternative II in her recommendations. Using Mr. Dagogy's argument, she added, the average net benefits per dropout prevented in Alternative III is $13,737 ($3,489,210 divided by 254). The average net benefits foregone per dropout not prevented (between Alternative III and a fully effective program) is only $6,928. Therefore, the difference between Alternative I and III represents an area of diminishing returns. Thus, Dr. Goodmind concluded that her recommendations were still sound. Alternative II is inferior to the other two alternatives; Alternative III is the best choice in terms of cost-effectiveness and the benefit-cost ratios; and Alternative I produced the largest net benefits and should be selected if there are no budget constraints.

At this point Mr. Dagogy raised the question of a "combined solution". Since one of the features of Alternative III is participant self-selection, the focus should be on those students that this alternative cannot reach. An approach like Alternative I, focusing on the 40 percent of the dropout not served by Alternative III, might be used in combination with Alternative III, Mr. Dagogy suggested, in order to meet all of the objectives associated with the dropout problem facing the Rurbania school system.

The focus of this scenario assignment, therefore, is on the further analysis of such combined solutions (discovery of the optimum envelope) that might provide a more effective approach (between 40 and 100 percent effective) for various budget levels.

INSTRUCTIONAL GUIDE #6: COMBINED SOLUTIONS

Initially it might be assumed that the cost curve for Alternative I is a linear function, and therefore, the program cost for 40 percent of this alternative would be 40 percent of the total program costs calculated previously, or $1,404,200. When added to the 60 percent coverage of Alternative III, this would produce a combined solution cost of $3,420,200 ($90,300 less than the cost of the 100 percent effective solution taken alone), which is an optimal solution from a cost-benefit standpoint.

However, the program requirements of Alternative I result in some "front-end" costs (particularly as related to the salaries of supplementary teachers), which produce something other than a linear configuration. Therefore, if a complete analysis of costs is made, as shown in Table 6-16, adhering to the parameters outlined in the case study, the cost of a 40 percent program under Alternative I would be $1,734,250. When added to the cost of Alternative III (at 60 percent effectiveness), the total cost is $3,750,250, which is higher than Alternative I taken as a whole. Thus, these calculations would seem to support the notion that, if there are no budgetary constraints (or to achieve a level of effectiveness greater than 60 percent), Alternative I should be selected.

One aspect of a combined solution that this analysis does not consider, however, is the base level of supplementary teachers provided by Alternative III. In cost-benefit analysis, this is known as an "inheritable asset", i.e., resources of one program that are applicable to another program (in this case, a combined solution) and serve to reduce the total cost of the second program. Thus, the required level of supplementary teachers to mount a 40 percent portion of Alternative I is reduced from a base level of 5 to 2, since Alternative III already supplies 3 supplementary teachers. That is to say, it is not necessary to have 8 supplementary teachers as a base level in the second year of the combined solution, but only 5 plus the one additional teacher per 20 students in the program.

Reducing the number of supplementary teachers required to support a 40 percent level of Alternative I also results in reductions in the number of support personnel required and in the level of supporting costs, as shown in Table 6-17. Thus, a combined solution which builds on the "inheritable assets" of Alternative III would have a total cost of $3,424,750, and a cost-effectiveness ratio of $8,077.24.

One further combined solution might be examined, involving a 40 percent level of effort under Alternative III and a 60 percent level under Alternative I. This combined solution takes advantage of the inheritable assets in connection with the base level of supplementary teachers required (in this case, the assets are "inherited" from Alternative I). Further, by assuming the base level of supplementary teachers under Alternative I, fewer support dollars are required in connection with these supplementary teachers than if the base is distributed between Alternatives III and I. At the same time, fewer support personnel are required under Alternative III. As shown in Table 6-18, the total cost of this combined solution is $3,410,083, resulting in a cost-effectiveness ratio of $8,042.65.

TABLE 6-16. Drop-Out Prevention Program: Alternative I at a 40 Percent Level of Effectiveness

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	122	48
Dropouts Prevented	6	13	30	40	48	26	7
Additional Students	0	6	19	49	89	137	41
In School	6	19	49	89	137	163	48
II. Input Section							
Counselors	0.5	1.0	2.5	4.5	7.0	8.0	2.5
Supplementary Teachers	0.0	6.0	7.5	9.5	12.0	13.0	7.5
Regular Teachers	0.0	0.5	1.5	2.5	4.0	5.0	1.5
Total Instructional Personnel	0.5	7.5	11.5	16.5	23.0	26.0	11.5
Support Personnel	0.0	1.5	2.5	3.5	4.5	5.0	2.5
III. Costs							
Counselors	$ 7,500	$ 15,000	$ 37,500	$ 67,500	$ 105,000	$ 120,000	$ 37,500
Supplementary Teachers	0	78,000	97,500	123,500	156,000	169,000	97,500
Regular Teachers	0	6,000	18,000	30,000	48,000	60,000	18,000
Support Personnel	0	15,000	25,000	35,000	45,000	50,000	25,000
Total Salaries	$ 7,500	$ 114,000	$ 178,000	$ 256,000	$ 354,000	$ 399,000	$ 178,000
Support Costs	1,250	19,000	29,667	42,666	59,000	66,500	29,667
Fiscal Year Totals	$ 8,750	$ 133,000	$ 207,667	$ 298,666	$ 413,000	$ 465,500	$ 207,667
Grand Total							$1,734,250

TABLE 6-17. Drop-Out Prevention Program: Alternative I with Inheritable Assets

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	122	48
Dropouts Prevented	6	13	30	40	48	26	7
Additional Students	0	6	19	49	89	137	41
In School	6	19	49	89	137	163	48
II. Input Section							
Counselors	0.5	1.0	2.5	4.5	7.0	8.0	2.5
Supplementary Teachers	0.0	3.0	4.5	6.5	9.0	10.0	4.5
Regular Teachers	0.0	0.5	1.5	2.5	4.0	5.0	1.5
Total Instructional Personnel	0.5	4.5	8.5	13.5	20.0	23.0	8.5
Support Personnel	0.0	1.0	1.5	2.5	4.0	4.5	1.5
III. Costs							
Counselors	$ 7,500	$ 15,000	$ 37,500	$ 67,500	$ 105,000	$ 120,000	$ 37,500
Supplementary Teachers	0	39,000	58,500	84,500	117,000	130,000	58,500
Regular Teachers	0	6,000	18,000	30,000	48,000	60,000	18,000
Support Personnel	0	10,000	15,000	25,000	40,000	45,000	15,000
Total Salaries	$ 7,500	$ 70,000	$ 129,000	$ 207,000	$ 310,000	$ 355,000	$ 129,000
Support Costs	1,250	11,667	21,500	34,500	51,667	59,166	21,500
Fiscal Year Totals	$ 8,750	$ 81,667	$ 150,500	$ 241,500	$ 361,667	$ 414,166	$ 150,500
Alternative III: 60% Effective	$ 18,000	$ 120,667	$ 216,000	$ 346,666	$ 510,667	$ 588,000	$ 216,000
Annual Totals	$ 26,750	$ 202,334	$ 366,500	$ 588,166	$ 872,334	$1,002,166	$ 366,500
				GRAND TOTAL			$3,424,750

TABLE 6-18. Drop-Out Prevention Program: Alternative III with Inheritable Assets

	Fiscal Year						
	1	2	3	4	5	6	7
I. Output Section							
Students Graduated	0	0	0	0	0	122	48
Dropouts Prevented	6	13	30	40	48	26	7
Additional Students	0	6	19	49	89	137	41
In School	6	19	49	89	137	163	48
II. Input Section							
Counselors	0.5	0.5	1.5	3.0	4.5	5.5	1.5
Supplementary Teachers	0.0	1.0	2.5	4.5	7.0	8.0	2.5
Regular Teachers	0.0	0.5	1.5	3.0	4.5	5.5	1.5
Total Instructional Personnel	0.5	2.0	5.5	10.5	16.0	19.0	5.5
Support Personnel	0.0	0.0	0.5	1.0	1.5	2.0	0.5
III. Costs							
Counselors	$ 7,500	$ 7,500	$ 22,500	$ 45,000	$ 67,500	$ 82,500	$ 22,500
Supplementary Teachers	0	13,000	32,500	58,500	91,000	104,000	32,500
Regular Teachers	0	6,000	18,000	36,000	54,000	66,000	18,000
Support Personnel	0	0	5,000	10,000	15,000	20,000	5,000
Total Salaries	$ 7,500	$ 26,500	$ 78,000	$149,500	$227,500	$ 272,500	$ 78,000
Support Costs	2,500	8,333	26,000	49,833	75,833	90,833	26,000
Fiscal Year Totals	$10,000	$ 35,333	$104,000	$199,333	$303,333	$ 363,333	$104,000
Alternative I: 60% Effective (from Table 6-15)	$ 8,750	$162,167	$253,167	$396,667	$556,500	$ 660,333	$253,167
Annual Totals	$18,750	$197,500	$357,167	$596,000	$859,833	$1,023,666	$357,167
				GRAND TOTAL			$3,410,083

CLOSING COMMENTS

As Charles Beard has observed: "Budget reform bears the imprint of the age in which it originated." Public budgeting in the United States has gone through three major stages since the turn of the century. The first stage was that early period in which the major emphasis in budgeting was the central control of spending--the traditional object-of-expenditure budget was viewed as a safeguard against administrative abuse of public funds. Obviously, this period was under the influence of government reformers, particularly at the local level. The second stage in this evolution was management-oriented, in which the emphasis was placed on the efficient performance of work. The performance budget --officially introduced by the Hoover Commission in the late forties-- was a major contribution of this period. The third stage had its origins in the "proclamation" of PPBS at the federal level. While PPBS met an untimely death at the hands of its strongest advocates, the planning orientation which it embraced survives in the concepts of program budgeting, mission budgeting, and zero-base budgeting.

All three of these stages coexist in modern public budgeting. "Coexistence" best describes the relationships among these three budgetary approaches. The input/output focus and informational needs of each are quite different, suggesting a major reason why, to date, these budgetary systems have not been more closely integrated.

The crystal ball would seem to indicate that further experimental "fission" is likely to characterize public budgeting in the coming years before a successful "fusion" is achieved. Budgeting cannot and should not be immune to changes that are in the making in our changing society. While none of the many efforts to reform public budgeting has fully succeeded, each has made some contribution to the current state of the art. The art, however, had seldom been satisfactory to the needs of the day, and the art of budgeting undoubtedly can be expected to change even more tomorrow,

ENDNOTES

1. For a more detailed discussion of these "grand optimization" models, see: Alan Walter Steiss, Models for the Analysis and Planning of Urban Systems (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1974).

2. No attempt will be made in this discussion to provide a step-by-step outline of the technical procedures of the Critical Path Method. Such guidelines are provided, however, in Catanese and Steiss, Systemic Planning: Theory and Application (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1970), chapter 7. Readers wishing to pursue this technique of network analysis in more detail may find a useful starting point with this description.

3. A decision problem in which the choice of a set of variables can be assumed to lead invariably to a specific value of the function is called deterministic. A decisions in a nondeterministic or stochastic problem leads to a set of possible outcomes under conditions where only probabilistic assumptions can be made.

4. A. R. Prest and R. Turvey, "Cost Benefit Analysis: A Survey," The Economic Journal (1965), p. 583.

5. Joseph A. Maciariello, Dynamic Benefit-Cost Analysis (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1975), p. 2.

6. Otto Eckstein, Water Resource Development (Cambridge: Harvard University Press, 1958).

7. For a further discussion of life-cycle costs, see: Alan Walter Steiss, Local Government Finance: Capital Facilities Planning and Debt Administration (Lexington, Mass.: Lexington Books, D. C. Heath and Company, 1975), chapter 10.

8. E. S. Quade, Analysis for Public Decisions (New York: American Elsevier Publishing Co., 1975), p. 92.